SCIENCE

FRIDAY, JANUARY 28, 1898.

CONTENTS:

LOGARITHMS ON THE 'SPOILS SYSTEM.'

WHILE the President of the United States is considering whether he will follow the advice of the naturalists of the country and appoint as Fish Commissioner a really competent man, or accept the recommendation of one of his political friends and select a man who, in the opinion of that friend, knows nothing of the duties of the position, but will 'catch on' if he is given a little time, a good many other people are examining, with no small degree of astonishment, a recent example of the results of managing one of scientific bureaus of the government on the spoils system.

This bureau has just issued its Annual Report, a large quarto volume, and of its 720 pages 325—nearly one-half—are given to the publication of a ten-place table of logarithms! If there never had been a ten-place logarithmic table before this there might be a shadow of an excuse for its publication by the government, but when such tables have been available for more than a hundred years, and can be bought almost anywhere for a small sum, it is difficult to imagine a reason for the printing of this one. Just what it has cost the government from first to last cannot very well be esti-

mated, but it has been put at not less than $20,000 by a widely known newspaper.

In the bureau from which it comes perhaps two or three copies of such a table might be used, but anybody who knows anything about the subject knows that useful tables of logarithms include from four to seven places. The number of problems in which a table of more than seven places would be used is extremely small, and all extension of figures over what are actually used are a nuisance and a real hindrance. That the United States government should suddenly print for free distribution several thousands of copies of this compilation must create, among those who understand, a strong suspicion of a dearth of other printable material.

A little examination of the introductory pages of this extraordinary work will intensify the wonder which its appearance produces. Some space is devoted to the consideration of the elements of trigonometry, assuming that young people who are ignorant of that subject will take to ten-place logarithms from the start.

Mathematicians will be interested and amused by this elementary work, which would properly astonish a high school pupil of the present day. Definitions of the trigonometric functions are quite erroneous and quite inconsistent with accompanying statements. Some novel mathematical principles are laid down, which go far to make the work worthy of preservation. But all of this goes for nothing at present, as no table of logarithmic sines, cosines, etc., appears in the present volume, and it is greatly to be feared that a new administration with less decided antiquarian tendencies may insist on the paramount importance of papers on hydrography, magnetism, geodesy and things of that sort, and thus defer the completion of this table for another hundred years.

The past is secure, however, and the ten-place 'logarithmorum vulgarium' cannot be taken from us, unless, indeed, the government calls in 'for redemption' the entire issue.

The printed tables show that they have been prepared for the select few, meaning the very select few who are ever likely to be found making use of them. Their arrangement might have been worse, but only by printing the numbers in one annual report and their logarithms in the next. No one will deny this who looks at the two broad quarto pages and tries to carry the line of a number, found only at the extreme left, across both pages to the corresponding logarithm, without being 'shunted off.' This difficulty is greatly enhanced by a gap of about three inches of blank paper diversified with binding stitches, over which one is expected to carry one's eye undeviatingly. Still further trouble comes from the absence of all grouping in the individual numbers. Seven figures, and ten figures, where there are ten, are packed up together, while in any well arranged table they are always grouped in blocks of two, three or four, so as to catch the eye readily and to be the more surely carried correctly in the head until written down. Every compiler knows how this matter of grouping and spacing may make the difference between a perfect table and one which is absolutely unusable.

Many other points might be commented upon, but it was not intended to make any extended criticism of a work which quickly proves to be unworthy of extended notice, except as an example of how a government may spend its money during a 'reform' administration. Of the fitness of the author for the task he has undertaken he has himself given the most valuable testimony. He says, "When these computations were begun I was not aware that Baron George von Vega had preceded me in his Thesaurus Logarithmorum Completus." This great work of Vega, which every tyro in computing knows, was published in 1794. This is more than a hundred years ago, and it is not easy to understand how one could seriously think of repeating such a performance without finding that it had already been done. The author thinks he has discovered some serious mistakes in Vega, but he delicately refrains from telling what they are, nor does he say that he has yet learned (a hundred years not having elapsed) that in 1889 Vega's tables were freed from all known errors, those discovered during a use of about one hundred years, and republished in Europe in a cheap form by a process prohibiting additional typographic blunders. Had he known this he must certainly have informed the Secretary of the Treasury that the expense of the present publication might be avoided. Not liking to imitate Vega in every respect, he adopted a different arrangement of numbers and logarithms, which he says is the same as that of 'the admirable tables published by Messrs. W. & R. Chambers, London and Edinburgh, 1885.' For this statement the Messrs. Chambers are surely entitled to action and recovery.

It is but just to the many able and distinguished scientific men serving in the bureau from which this publication comes to say that it was prepared by their chief, published under his name and by his order. They have had nothing to do with it, except, doubtless, to reduce, as far as possible, those errors which yield to ordinary 'proof reading.' Nor must the author be blamed severely, as he is rather deserving of pity. For this costly and worse than absolutely useless production the country is indebted to the 'spoils theory' in politics, and it represents but a minute fraction of what that theory has cost in government scientific work alone. We have good reason to hope that the present administration will avoid the mistakes that must follow in the wake of politics applied to the great scientific bureaus of the government.

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*THE UNITED STATES NAVAL OBSERVATORY.**

THE history of the Naval Observatory, since its separation from the Hydrographic Office, will naturally be looked for in its annual reports, which are found in the reports of the Navy Department. In 1866 the building of a splendid new observatory was commenced on such a scale that several years were required for its completion. In 1894 Secretary Herbert framed regulations for its government, the most impor-

*We have been requested to reprint this article from the *New York Evening Post* of January 19th. If the criticism of the trivial character of the work of the Observatory is well founded the matter should be brought to the attention of those interested in the efficiency of the scientific work of the government. If the strictures are incorrect those responsible for the management of the Observatory should be allowed to reply in a scientific journal.—ED. SCIENCE.

tant feature of which was the establishment of the office of Astronomical Director, subordinate to that of Superintendent. This arrangement was the act of the Secretary himself, and not of Congress. Both the Superintendent and the Director are detailed from the navy, the first being a line officer, the second a professor; but we find no law establishing their offices.

In one point, at least, the advent of the Astronomical Director is marked by a great improvement. During the years before 1894 the annual reports are confused and disjointed, exciting more curiosity than they gratify, and showing no connection from year to year. Since that date they have been clear and well arranged. But this improvement in form only brings out in bolder relief a feature which runs through nearly all these documents. The report of the Astronomical Director for 1897, which has just been issued, fills six pages; a small space, one would suppose, in which to condense the history of a year's work of such an institution. Yet one-half of this space is taken up with particulars which to the lay reader seem trivial. Is it the Secretary of the Navy or is it an astronomer who will want to know, a year after the event, that on September 3, 1896, the 'finder' of one of the telescopes was supplied with a new leather cap? The most elaborate passage in the whole report is devoted to an account of difficulties encountered in raising an 'elevating floor' by steam-pumps and the happy result of substituting water as the motive power. 'To Professor J. R. Eastman, U. S. N., four star-places were furnished; to Professor Edgar Frisby, U. S. N., two star-places were furnished, and to Professor S. J. Brown, U. S. N., nine star-places were furnished,' these gentlemen being all officers of the Observatory. Do these communications between members of the staff interest the world outside? Does the astronomer want to know in detail what objects could not be seen with the telescopes, and what good intentions were frustrated by bad weather and other untoward circumstances? If the importance of a subordinate is to be measured by the number of times he is mentioned by name, the most important man in the place must be a Mr. Kahler, whose office is not stated, but who appears to be a mechanician. This gentleman's work is reported with truly astronomical precision as to dates. On September 3, 1896, the disc of a micrometer head was found bent; he straightened it out the next day. September 8th he supplied the clamp for the draw-tube of a finder. January 19, 1897, he finished grinding a lens. February 18th he cleaned, oiled and repaired the machinery of the dial of one of the telescopes, and so on.

The estimates for the support of the Observatory during the next year are in round number $56,000 for current running expenses, and $34,000 for grounds, roads, building, etc. If to this we add the salaries of officers and professors paid from the navy fund, some $25,000, it will make a total of $115,000. The report of the establishment should certainly give the public such information as will justify this expenditure. We should like to know what important researches are being carried on, what improvements are being made in the observations, and what results of value are likely to accrue to astronomical science. But we have been unable to find, either in the reports or elsewhere, anything to gratify this curiosity. Besides trivalities like those we have already mentioned, the astronomical report gives mostly a highly technical statistical statement of the number of observations made with four of the instruments, and of the progress of the calculations connected with them. It is difficult to perceive how even a professional astronomer could infer anything from the bare facts that 109

miscellaneous stars and 2,832 American Ephemeris stars were observed; that 'in declination the interpolation of the refractions has been finished,' etc.

A curious impression conveyed by the report is that, excepting the Astronomical Director, who has the most important part of all, the professors seem to have less important work assigned to them than the assistant astronomers have. The perfunctory flavor which permeates the whole report is especially strong in the statements of the work of the telescopes: "The positions of two stars were measured for the use of the twenty-six-inch telescope. Eight occultations of stars by the moon and five eclipses of Jupiter's satellites were observed. The diameter of Venus was measured on seven different days, and the sun was examined for spots on four days." Why on four days and no more? The report of the work of one professor is condensed into a single line with the remark that he assists Lieut. Charles E. Fox, U. S. N.

We must in justice state that the Observatory does other than astronomical work. It prepares and publishes the 'Nautical Almanac;' but this is done at the expense of a separate appropriation which we have not included in our statement of estimated expenditures. There is a department of meteorology and magnetism. Why pursue meteorology in the presence of the Weather Bureau and the Hydrographic Office? Sad havoc has been made with the magnetic observations by the building of an electric railway in the neighborhood. There are also departments of time service and nautical instruments, the value of which to the naval service, it is declared, 'cannot be overestimated.' Is not this statement a little strained? It is true that a very impressive list of scientific instruments issued to ships of the navy is given. But the careful reader who makes inquiry will find that the greater number of them can be purchased at prices ranging from 50 cents to $10 each. Do the inspection, care and issue of these instruments really form an important part of the work of the establishment? If they do, it will be well to reflect that the great ocean liners, obliged to make their time in all states of the weather, must be navigated as carefully as a ship of war, and that it costs their owners nothing to inspect and issue the necessary instruments. Every captain is assumed to be competent for this duty, and we can find no record of a case in which the loss of a ship was traced to the imperfection of a sextant, spy-glass or chronometer.

What was the Observatory built for? What do the scientific men of the country and of the world think of its work? What credit does it do the officers of the navy concerned in its management? What relation has its work to the wants of the naval or any other branch of the public service? What measures are taken by the Navy Department to insure its scientific output being of real value? We are unable to find an answer to these questions in any official publication.

CLIMATOLOGY AS DISTINGUISHED FROM METEOROLOGY.

THE term Climatology is very frequently treated as synonymous with Meteorology. There is an important distinction, however. which should be generally recognized. Climatology is a distinct branch of meteorology, an application which should not be confounded with the broader subject.

Meteorology includes, in the broadest sense, the various atmospheric phenomena. The subject may be conveniently divided into two parts: The study of the laws and principles involved in the movements of the wind; the formation of clouds; the formation and precipitation of rain, snow and hail; the absorption and radiation of heat and the like. The second part consists of

the statistical records of the extent and frequency of the changes of the various atmospheric phenomena.

Climatology is a function of these phenomena and should be expressed in terms of the development of organic life. Climatic changes produce, in many ways, more apparent changes in plants than in animals, and they should be taken as the standard in the interpretation of our meteorological data. Many plants are far more sensitive in recording climatic changes than our meteorological instruments. There are localities where the character of the leaf or the peculiar excellence of the fruit produced show peculiarities in the climate which the instruments fail altogether to record, or rather which we have never yet been able to deduce from the ordinary meteorological records. The development of plant life should, therefore, be taken as the standard with which our instruments should be compared and our methods adjusted in order that the elements of climatology may be worked out from our meteorological records.

Climatology is not a simple summation, but a complicated expression involving the general relation of certain functions of meteorological elements, the values of which we do not as yet understand. The principal elements influencing the economy of plant life are temperature, humidity, wind velocity, water supply and sunshine. Within certain limits the activities of the plant are dependent upon the relation between these elements. Thus temperature causes evaporation, the relative humidity and the velocity of the wind control evaporation, while the moisture supply in the soil provides the plant with water to replace that lost by evaporation. The influence of all depends upon the total intensity of the sunshine.

The rainfall, although a very important meteorological element and of great economic and commercial importance, is not considered a factor in climatology, as it is not the immediate source of the water supply of plants. The soil is the receptacle of the rainfall and, through the resistance it offers to the descent of water and through capillary action, maintains the water at the disposal of plants. Hence the moisture content of a soil is an essential factor in climatology. Furthermore, as the soils in the same field may differ greatly in their power to retain water, we may have very different climates over very small areas. With forty inches of annual rainfall the soil may be so open and porous and retain so little moisture that the conditions may be truly arid. We have small areas of truly desert lands in our Eastern States. On the other hand, with only eight or nine inches of annual rainfall there are some soils so retentive of moisture that they will produce good crops with careful and thorough cultivation.

The general relation of these elements may be expressed in very general terms in the following equation:

$$\text{Sunshine}\left(\frac{\text{Temp.} \times \text{wind veloc.}}{\text{Humid.} \times \text{soil moist.}}\right) = \text{Const. condition of plant growth.}$$

This is but an expression of facts perfectly well known to greenhouse men. It will be seen from this that to maintain constant conditions of growth any marked change in one of the elements must be followed by a change in one or the other of the remaining elements. Thus, if the temperature rises, the wind must fall or the humidity or soil moisture increase. If the humidity increases, the temperature or wind velocity should increase or the soil moisture should decrease. The sunshine should be recorded by the total intensity rather than by the duration. If the intensity should decrease, the other elements should all be lowered and *vice versa*. If the above equation holds, it appears that the change in either the humidity or soil moisture or both must be

relatively greater than the change in temperature. We have here, then, the principle upon which climatology should be worked out. Given a plant whose pedigree and habits of growth are well known, and a daily range in temperature from 65 to 70 degrees, what range of moisture in the soil can the plant stand? what relative humidity? wind velocity? and what intensity of sunshine? With a certain amount of sunshine, what temperature, humidity, moisture and wind velocity are necessary to maintain the favorable conditions of growth? This is climatology, and there is no reason why the approximate relation of these elements should not be worked out for different classes of plants and for different periods of their growth. The florist knows how to control these conditions to produce the development he desires or to mature the plant at any time. He does this by watching the plant itself, using the thermometer merely as an indicator of the changes he makes in the temperature. It is intuition on his part which he can not explain. It is a matter of experience and observation which he can not impart to others. If the meteorologist should observe and record these changes by his instrument as the florist is observing and controling the development of his plants it should be possible to express the relation of the climate in language which could be imparted to others. This applies also to field culture.

One encouraging thing in this conception of climate is the fact that through cultivation we may very materially control the water supply of the soil. As this is an essential element of climate, we have then the power of modifying the climate of any locality to a considerable extent.

As the relation shown in the above equation is between certain functions rather than between the values as expressed in our ordinary meteorological tables, the equation should be written in still more general terms. Furthermore, the conditions favorable for one class of plants are not favorable for others, and the conditions favorable for the growing period of many of our crops are not favorable for the ripening period. The general equation should then be written as follows, the Greek letters standing for certain functions of the elements of which we do not as yet know the values:

$$(1) \qquad \psi(s)\left(\frac{\phi(t)\ \ \theta(v)}{\Gamma(h)\ \Delta(w)}\right) = k$$

$$(2) \qquad \psi'(s)\left(\frac{\phi'(t)\ \ \theta'(v)}{\Gamma'(h)\ \Delta'(w)}\right) = k'$$

where s = intensity of sunshine; t = temperature; v = velocity of the wind; h = relative humidity; w = soil moisture; and k = the constant conditions favorable for plant growth. Equation (1) may represent the conditions favorable for the vegetative or growing period and equation (2) the conditions favorable for the ripening or fruiting period. The values for some of the elements may be the same in both equations or they may all be different.

Climatology is thus shown to be the relation between the meteorological elements as measured by the development of the plant.

MILTON WHITNEY.

DEPARTMENT OF AGRICULTURE.

THE AGE OF THE ARTIFACT-BEARING SAND AT TRENTON.

ON three different occasions during the past summer I examined the deposits on the Lalor farm at Trenton, in which numerous artifacts have been found. So far as my observation goes, nothing was seen to prove that they were not *in situ*. In all cases noted they were found with longer diameters horizontal, *i. e.*, in the position they would naturally occur if their age is the same as that of the sand in which they are found. No positive evidence was noted that the sand had been so disturbed that they might have been intruded from above.

On the other hand, they all occur within less than four feet of the surface, in the zone in which the sand may repeatedly have been disturbed by up-rooting of trees, burrowing animals and Indian burials. Nothing of structure was seen in the sand itself by which this crucial question could be positively determined. The 'red clay films' observed at various intervals in the sand are not, in my opinion, lines of stratification at all, nor are they strongly clayey. They are rather zones or bands of infiltration and deposition of ferric oxide which has somewhat cemented the sand grains. Since they are not lines of stratification, the fact that they are continuous above the specimens is not necessarily conclusive proof that the latter are *in situ*. Nevertheless, in spite of the absence of decisive evidence pro or con, I am inclined to the view that the artifacts are *in situ* and not intrusive.

The deposit in which they occur is, in my opinion, dune-sand, accumulated after the river had partially or completely excavated its trench below the level of the Trenton terrace. The reasons for this conclusion in brief are as follows:

1. *The location.* The trenches are all within 100 or 150 feet of the edge of the terrace, which here overlooks a broad sandy flood plain. According to the testimony of those who have explored most thoroughly, the artifacts are found most abundantly in the sand near the edge of the bluff. The location is one peculiarly favorable for the accumulation of wind-blown sand driven by southerly and westerly winds and derived from the steep face of the terrace before it was covered by vegetation. As the river eroded its channel below the terrace level and left bare the freshly cut bank of sand and gravel, the prevailing winds undoubtedly swept sand on to the terrace. Naturally, some would accumulate along the edge of the bluff. I have observed wind-blown sand at many points in exactly similar positions farther north along the Delaware.

2. *The topography.* In the immediate vicinity of the trenches the surface of the terrace is slightly irregular, being diversified by low swells and saucer-like depressions. The surfaces of the swells are more sandy than of those parts of the terrace where the undulations are not present. Occasional large boulders occur on the surface of the terrace, but none were noted on the sandy knolls. Certainly none occur in the immediate vicinity of the trenches. In saying that the surrounding topography is at least *suggestive* of wind action I am not overstating the facts. In this connection, too, it should be noted that the present flood-plain is marked by low dunes now in the process of formation, and the similarity of surface is thus clearly brought out.

3. *The deposit.* Beneath the layer of forest loam, measuring six to ten inches in thickness, there is loose yellowish sand absolutely without structure lines, but traversed by two or three more or less distinct films, which, as noted above, are probably due to infiltration of ferric oxide. Beneath the yellowish sand, which has a maximum thickness of less than three feet, there is a reddish layer of sand, eight or ten inches thick, grading downward into the cross-bedded sand and gravel, which all are agreed is of glacial age and in which the artifacts are not found. In the artifact-bearing sands there is no evidence that it was water-deposited. That it is a local deposit is shown by the fact that it does not occur on the gravel seen in large open pits a few hundred yards distant from the trenches. It seems to be best developed along the edge of the terrace. Its texture is not unlike that of wind-blown sand observed elsewhere, and it is decidedly unlike the sand-beds exposed in the gravel pits. This latter fact, however, does not neces-

sarily separate it from the glacial deposited beds, although it points to such a separation.

If it is wind-blown sand, then the reddish layer between it and the cross-bedded sand and gravel probably represents the upper surface of the Trenton gravel and was the terrace surface during the interval between the accumulation of the glacial gravel and the wind-blown sand. This layer was examined very carefully in the hope of finding proof of its being an old soil. No humus staining, however, was observed, and its absence may be an argument against the view here advanced. It is not a fatal objection, however, since its absence can be satisfactorily explained by the oxidation and leaching which the whole mass has undergone. This action is still going on, for the humus staining is being leached out of the underside of the present soil, as is indicated by its mottled appearance through a zone five or six inches thick.

4. The presence of at least one wind-eroded pebble in the sand lends some strength to this interpretation, although in the light of the studies of Davis and Woodworth on Cape Cod it cannot be regarded as conclusive.

The presence of scattered pebbles in the sand, too large to have been moved by the wind, may at first sight seem to be fatal to this view, but when all the facts are considered it is not so. That man was present is indicated by the artifacts found. The bank from which the pebbles may have been carried by human agencies is hardly more than a hundred feet away. Although the presence of the pebbles may, to some degree, weaken the argument it is not fatal to it.

My conclusions are, therefore, that the artifacts are probably found *in situ*. There is no positive evidence that the sand deposit is water-laid, and there are strong reasons, although perhaps not conclusive, that it is wind-blown. In the latter case it may date from a period much later than the accumulation of the Trenton gravel. It seems most reasonable to suppose that it had accumulated after the river had cut its channel somewhat below the level of the terrace and formed a freshly-cut bluff, from which the sand was derived. The localization of the sand along the present bluff and the reported greater abundance of the artifacts in the sand nearest the bluff supports this conclusion.

Substantially these same conclusions were reached by me at the time of my first visit to this locality, and my later observations served only to confirm them. In a letter to Professor Mercer, written about July 1st, I stated this view as to the origin of the sand, and the same conclusions were expressed to Professor Smock even earlier. Ever since my first visit to this locality I have been of the opinion that these deposits are probably æolian and that they certainly do not represent the closing stages of the Trenton gravel.

HENRY B. KÜMMEL.

LEWIS INSTITUTE, October 25, 1897.

SOCIETY FOR PLANT MORPHOLOGY AND PHYSIOLOGY.

THE first meeting of this Society was held in conjunction with the meeting of the American Society of Naturalists and the Affiliated Societies at Sage College, Cornell University, December 28 and 29, 1897. The following papers were presented:

1. *A Mycorhiza in the Roots of the Liliaceous Genus Philesia.* DR. J. M. MACFARLANE, University of Pennsylvania.

A NEW case of this kind of Symbiosis was fully described and the conclusion reached that while the fungus might for many generations aid the host in the elaboration of protein compounds, ultimately though very gradually the fungus proved a destructive agent.

2. *Studies on some Mycelium, and Fungi from a Coal Mine* (illustrated by lantern views). Professor G. F. Atkinson, Cornell University.

The author described and illustrated by lantern views the remarkable developments of mycelia on the wooden beams, etc., of an abandoned part of a coal mine near Wilkesbarre, Pa. He photographed these by flashlight, and found fruiting specimens by which several of the species were determined.

3. *Is there Basidiomycetous Stage in the Life-History of some Ascomycetes?* Dr. E. A. Burt, Middlebury College.

The author has been unable, by the study of collections made in August, October, November, December, to confirm Massee's observations on the basidiomycetous nature of *Dacryopsis Ellisiana* and, therefore, is unable at present to conclude with Massee that *D. Ellisiana* is a basidiomycetous stage of the Ascomycete *Lecanidion leptosperma*.

4. *Additional Notes on the Bacterial Brown Rot of Cabbages.* Dr. Erwin F. Smith, Department of Agriculture.

Additional studies by the author have shown how the disease is disseminated, how the infections take place, how it persists in localities where it has once appeared, its host plants and how it may be restricted. An account of the economic aspects of the disease has been published by the Department of Agriculture as a Farmers' Bulletin.

5. *Occurrence of Kramer's Bacterial Disease on Sugar Beets in the United States.* Dr. Erwin F. Smith, Department of Agriculture.

This paper calls attention to the existence, in parts of the United States, of a disease of sugar beets resembling, if not identical with, that described by Kramer and Sorauer in 1891–1892, and more recently by Busse. The characteristics of the disease were described.

6. *Are Blepharoplasts Distinct from Centrosomes?* Mr. Herbert J. Webber, Department of Agriculture.

Blepharoplasts, the speaker pointed out, are special organs of the spermatic cells of Zamia, Gingko and some Filicineæ and Equisetineæ, which in certain stages of their development somewhat resemble centrosomes. Two are formed in each generative cell, arising *de novo* in the cytoplasm on opposite sides of the nucleus and about midway between the nuclear membrane and cell wall. The division of the generative cell results in the formation of two antherozoids, one blepharoplast being located in each antherozoid cell. During the division the blepharoplasts burst and the outer membrane becomes gradually extended into a narrow helicoid spiral band from which the motile cilia of the antherozoid are developed.

The blepharoplasts resemble typical centrosomes: (1) in position, being located on the opposite side of the nucleus, and (2), in having the kinoplasmic filaments focused upon them during the prophases of the division of the generative cell. They differ from typical centrosomes, however: (1) in arising *de novo* in the cytoplasm; (2) in growing to comparatively enormous size; (3) in not forming the center of an aster at the pole of the spindle during mitosis; (4) in having a differentiated external membrane and contents; (5) in bursting and growing into a greatly extended cilia-bearing band, the formation of which is evidently their primary function; (6) in their non-continuity from cell to cell.

7. *Spore Formation in some Sporangia.* Dr. R. A. Harper, Lake Forest University.

This paper described the homologies in the modes of spore formation in a number of Sporangia.

8. *Two New Organs of the Plant Cell.* Mr. Walter T. Swingle, Department of Agriculture.

THE author announced the finding of two new organs or organoids; the one, *Vibrioid*, occurring abundantly in the superficial layers of the protoplasm of some Saprolegniaceæ and Florideæ, and the other a central body in the developing egg of *Albugo candidus*. Both have been observed before but not correctly described. Both are fully described in this paper. The author can suggest nothing as to the function of the former, but thinks the latter plays some part in the delimitation of the egg within the oögonium, and the fusion of the male and female nuclei.

9. *Notes on the Archesporium and Nucleus of Bignonia.* MR. B. M. DUGGAR, Cornell University.

THE author gives a detailed account of his observations on the microsporic and macrosporic archesporium in this genus. The archesporial nucleus is peculiar in possessing a large nucleolar-like structure which does not stain homogeneously.

10. *Some Theories of Heredity and of the Origin of Species Considered in Relation to the Phenomena of Hybridization.* MR. WALTER T. SWINGLE, Department of Agriculture.

OWING to limited time, Mr. Swingle treated only the part of his subject which relates to facts of hybridization and their bearing on theories of heredity. He cited facts from his own observations and from the literature which cannot be explained by Weismann's theory of reduction of the chromosomes. He considers it necessary to assume, in some cases at least, a predetermination of the characters of the hybrid at the time of the fusion of the male and female nuclei. The male and female chromosomes probably persist side by side unchanged in number, and possibly unchanged in quality, during the whole of the ontogeny of the hybrid. It is also necessary to assume that the influence exerted during ontogeny of the hybrid by the material bearers of heredity is, at least in some cases, a function of their relative positions. Xenia is well established and, together with cases where the mother-plant influences the developing embryo, is inexplicable by most of the current theories of heredity, and necessitates the assumption that hereditary influences can be transported from cell to cell for some distance.

11. *Variable Reaction of Plants and Animals to Hydrocyanic Acid Gas.* MR. ALBERT F. WOODS, Department of Agriculture.

PLANTS of various families and in different stages of growth were subjected to varying amounts of hydrocyanic acid gas, and were found to be affected by it in different degrees, according to the kind of plant, its age, and other conditions of growth and development. Animals, mainly insects, were also found to vary, even within the same family, in like manner. Mites were the most resistant of any of the organisms studied, often recovering after several hours of complete paralysis and apparent death.

12. *Effect of Alternating Dryness and Moisture on the Germination of some Seeds.* MR. A. J. PIETERS, Department of Agriculture.

THE experiments recorded are preliminary to more extensive ones now in progress, but they show clearly that for some seeds germination is quickened by thorough drying after a long period of dampness. In most cases after a small percentage of germination for the first one hundred days or more, drying for two weeks followed by wetting resulted in a germination of from 15 to 54 per cent. in a few days. In the check pots, meanwhile, the seeds either did not germinate or only a small per cent. did so.

13. *Experiments on the Morphology of Arisæma triphyllum.* PROFESSOR G. F. ATKINSON, Cornell University.

THE author described his experiments by

which he had been able, by growing male and neuter plants of this species in rich soil, to change them to female plants, and by removing a part of the stored food supply of female plants to change them to male.

14. *On Polyembryony and its Morphology in Opuntia vulgaris, Mill.* Dr. W. F. Ganong, Smith College.

The author has found this species to be polyembryonic, with a double morphological basis; one set of embryos develops from a mass of tissue which he believes to arise from the fertilized egg-cell, while the other arises on the walls of the embryo-sac, but not from the nucellus, but probably from an endosperm cell, which, if true, is a new mode.

15. *Contributions to the Morphology and Biology of the Cactaceæ.* Part II., *The Comparative Morphology of the Embryos and Seedlings.* Dr. W. F. Ganong, Smith College.

This paper is a continuation of the author's earlier studies on this family. It describes and figures germinated embryos of most of the genera and many important species, discusses germination and growth of the seedlings and the unfolding of the peculiar morphological features of the adults, together with the form, size and color factors of the embryos and seedlings, and what these show of importance for the determination of the phylogeny of the genera.

16. *The Morphological Significance of the Lodicules of Grasses.* Dr. W. W. Rowlee, Cornell University.

A study of the flowers of Bamboos leads to the conclusion that the lodicules of grasses represent a reduced perianth. The three lodicules in *Arundinaria* alternate with the stamens, and may, therefore, be considered the inner whorl or petals. The stamens are directly opposite the midribs of the carpels, and indicate that the inner whorl of stamens, present in some bamboos, is suppressed in *Arundinaria*. Hackel interpreted the lodicules as distichous bracts.

17. *Observations on the American Squaw-root (Conopholis Americana, Wallr.).* Dr. Lucy L. W. Wilson, Philadelphia.

This paper contained an exhaustive study of the vegetative characteristics of this parasite and of its relations to its invariable host, the Oak. Because of its extreme degradation and the intimacy of its relation with the host, the author compared it with members of the Balanophoreæ and Rafflesiaceæ rather than with parasitic Scropulariaceæ.

18. *Water Storage and Conduction in Senecio præcox, DC., from Mexico.* Dr. John W. Harshberger, University of Pennsylvania.

This species, inhabiting volcanic beds in the Valley of Mexico, shows a remarkable method of storing water in the pith, and prevents its too rapid loss in the dry season by protective layers of cork and balsam. The water is conducted to the vegetative points by bundles which project into the pith. The histological characters are fully described.

19. *Notes on the Embryology of Potamogeton.* Mr. K. M. Wiegand, Cornell University.

The author had studied the origin and development of the embryo-sac, fertilization and development of the embryo in this species. Although the normal number of cells is present in the egg-apparatus and the antipodals they form irregularly. Of particular interest is the fact that the definitive nucleus cuts off a very large basal nucleus, as in Sagittaria, before endosperm formation proceeds.

20. *Recent Experiments and Observations on Fruit-Production in Amphicarpæa.* Dr. Adeline Schively, Philadelphia Normal School.

This paper continues the author's recently published observations on this subject, and

she now shows that aërial flowers, when buried at any period before fertilization, produce the underground kind of fruit, and not the kind they would have produced in their normal position, from which the author draws conclusions as to the very powerful action of the environment upon seed production and structure in this species.

21. *On the Formation of Cork Tissue in Roots of the Rosaceæ.* DR. MARTHA BUNTING, Philadelphia High School.

THE author showed that intercellular spaces exist between the cork cells in all herbaceous and shrubby species of Rosaceæ examined by her, but these are absent in arborescent species; protoplasm, nuclei and starch grains exist in cork zones four to five layers removed from the phellogen.

22. *The Structure and Development of Internal Phloem in Gelsemium sempervirens, Ait.* MISS CAROLINE THOMPSON, University of Pennsylvania.

THE mode of formation of the internal phloem in the pith of this species, and the way in which it crowds out the pith in its growth, together with a remarkable arrangement of the bundles in the petiole, are fully described.

The officers for the ensuing year are: President, W. G. Farlow; Vice-Presidents, J. M. Macfarlane, G. F. Atkinson; Secretary-Treasurer, W. F. Ganong.

The next meeting of this Society will be held in December, 1898, in conjunction with the American Society of Naturalists and the Affiliated Societies.

W. F. GANONG,
Secretary.

REPORT OF THE COMMITTEE ON ANTARCTIC EXPLORATION.

AT the Philadelphia meeting of the American Society of Naturalists, held in December, 1895, a committee was appointed to inquire into the practicability and feasibility of the exploration of the Antarctic Continent. This committee made a report to the Society, which was published in the 'Records' of the meeting of 1896, and the committee was continued, with power to add to its number. The following report was received by the Secretary too late to be presented at the recent Ithaca meeting.

H. C. BUMPUS,
Secretary.

Your Committee on Antarctic Exploration respectfully report that they have further considered the subject-matter which was referred to them, but regret that they are still not in a position to give assuring indications as a result of their inquiries. The seeming impossibility of obtaining a suitable vessel and sailing crew in any of the southern South American ports, and the non-willingness of the Newfoundland fishing and whaling interests to associate themselves with so distant enterprises as would be involved in any form of Antarctic exploration, complicate the problem very materially, or, at least, set so high an estimate upon general costs as to make the realization of an expedition at a period of financial depression somewhat of an uncertainty. It has been found impossible to ascertain what form of assistance might be obtained from the Australian whaling fleets, but the letter which was addressed to your Committee by the late Baron Ferdinand von Müller intimates that little assistance of any kind should be relied upon to come from that quarter.

Your Committee have been in correspondence with Civil Engineer Robert E. Peary, relative to the subject of the inquiry, and have obtained through him valuable data bearing upon general costs and possibilities, notably in a series of estimates that were submitted to him by Mr. H. J. Bull, of Christiania, Norway, intended to cover one or more joint commercial (whaling) and scientific enterprises, and to yield a

profit to those undertaking the burden of schemes suggested. Mr. Bull is virtually the organizer of the cruise of the 'Antarctic' in the years 1894–95, when a landing was effected on the assumed Antarctic Continent at Cape Adare, and his opinions and estimates are deserving of respectful consideration. He confidently assumes that a joint commercial and scientific expedition could be arranged so as to render its outcome largely profitable to investors, even to the extent of £500 or more, and yet so directed as to place it mainly to the purposes of scientific investigation. In his various estimates, however, which cover the purchase of one or more suitable steamers, the absolute hiring of full officers and crews, the amount of capital required is so large, £9,000 to £14,000, as to render an association in this form of combined enterprise doubtfully desirable. Your Committee believe that an expenditure of $40,000 to $50,000, or perhaps even less, would suffice to construct an independent scientific expedition of its own, which would be in every way, if we may judge by past experience and results, to be preferred to an expedition whose associations must be largely commercial. Your Committee believe that independent subscriptions to the extent of $40,000 or $50,000 could be obtained at this time only with great and united effort, and yet it is by no means impossible that patrons of exploration may be found who would generously contribute to the fund of a properly organizing expedition. And it is almost certain that Arctic and Antarctic enterprises, despite the generous criticisms which are meted out to them in various quarters, will, for a long time, receive the favor of American good-will and protection. It seems very probable, also, that a selected number of scientific associations and institutions of general learning, such as universities and colleges, might be induced to coöperate to a common end, sending representatives to an expedition proportional to amounts of cash subscriptions.

Your Committee, if so desired, will be pleased to still further prosecute their inquiry. It is with satisfaction that they report the departure of the Belgian Antarctic Expedition under command of Lieutenant Gerlache, and with it the association of the American explorer, Dr. F. A. Cook, a prominent member of the Peary Expedition of 1891–92.

Respectfully submitted,

Angelo Heilprin.

Chairman Committee on Antarctic Exploration.

ELIZABETH THOMPSON SCIENCE FUND.

At a meeting of the Board of Trustees, held at Boston January 13, 1898, reports were read from the recipients of previous grants, and the record of the following grants was closed, the authors having published their investigations:

No. 54. Samuel H. Scudder, Esq., of Cambridge, Mass., $250, granted June 29, 1894, for a monograph on the caliptenoid series of North American Acridians. The publication is: 'Revision of the Orthopteran group Melanopli (Acridiidæ) with special reference to North American Forms.' *Proceedings U. S. National Museum*, Vol. XX., p. 1–421, Pl. I.–XXVI.

No. 64. Dr. Julius Elster and Dr. H. Geitel, Wolfenbüttel, Germany, $185, granted April 8, 1895, for photo-electric investigations with polarized light. The publication is: 'Ueber die Abhängigkeit des Photoelectrischen Stromes vom Einfallswinkel und der Schwingungsrichtung des erregenden Lichtes und seine Beziehung zu der Absorption des Lichtes an der Cathode.' Annalen der Phys. u. Chem. N. F., Bd. 61, p. 445–465.

The following new grants were made:

No. 72, $150 to Professor J. McK. Cattell, Garrison-on-Hudson, New York, for the Study of fatigue in relation to mental conditions. Application 737.

No. 73, $250 to Professor J. von Kennell, Dorpat, Russia, for a Monograph of the palæarctic Tarteicidæ. Application No. 742.

No. 74, $300 to Professor Georges Urbain, 1 Rue Victor Cousin, Paris, France, for the chemical investigation of rare earths. Application No. 746.

No. 75, $25 to Professor Wm. Z. Ripley, Massachusetts Institute of Technology, Boston, Mass., for a Bibliography of the Anthropology and Ethnology of Europe. Application No. 747.

No. 76, $300 to Professor A. Bélopolsky, Observatoire centrale, St. Petersburg, Russia, for Experiments on the Principle of Doppler-Fizeau. Application No. 749.

No. 77, $100 to Professor C. H. Eigenmann, Bloomington, Illinois, for the Study of Blind Fishes. Application No. 751.

No. 78, $250 to Professor P. Francotte, Rue Gillon 66, Brussels, Belgium, for the investigation of the fecundation and segmentation of the eggs of Polyclada. Application No. 755.

New applications will be considered in January, 1899, provided they are received by the Secretary before December 1, 1898. Circulars announcing the terms of the trust for the guidance of applicants may be obtained by application to the Secretary.

CHARLES SEDGWICK MINOT,
Secretary.

HARVARD MEDICAL SCHOOL,
BOSTON, MASS., January 22, 1898.

JOHN A. GANO.

MR. JOHN A. GANO, of Cincinnati, Ohio, who died on January 15th, should be remembered by Amerian scientists as the one who most efficiently encouraged the establishment of a system of daily weather predictions for the benefit of business men. This subject was suggested in my inaugural address, as Director of the Observatory, in May, 1868, and Mr. Gano, as one of the trustees, at once took the matter up for favorable action. On the 28th of July, I explained it more fully to him and, at his request, put my ideas in writing for his use as editor of the Cincinnati *Commercial*. In 1869 he became President of the Chamber of Commerce, and a second letter from me was requested by him, which gave him the desired opportunity to urge the matter upon the attention of that body. He appreciated the whole scope and bearing of the proposed work; he appointed the Committee of Conference and in every way forwarded the enterprise with the greatest intelligence and discretion. After the 'Weather Bulletin of the Cincinnati Observatory' began to appear, September 1, 1869, he advocated a still wider extension of the work. I had already visited the Chicago Board of Trade and written to the daily papers of New York City, hoping to extend the scope of our work. In addition to this, Mr. Gano and Mr. William Hooper, as delegates to the National Board of Trade meeting at Richmond in November, 1869, contemplated bringing our work to the attention of that body, but when they found a scheme already formulated by my correspondent, Professor I. A. Lapham, and the Hon. H. E. Paine, of Milwaukee, and about to be presented by the Hon. C. D. Holton as delegate from the Milwaukee Board of Trade, they heartily supported that and on their return to Cincinnati assured me that they regarded a national weather bureau as the inevitable outcome of the work at Cincinnati.

The Cincinnati Weather Bulletin and predictions of 1869 was really my personal effort to utilize science for the benefit of the people, but historically it may also be considered as a revival of the reports and maps started by Espy and Henry, under the joint auspices of the Federal Government and the Smithsonian Institution, in 1848, and maintained at Washington with the coöperation of the various telegraph companies until 1861. Professor Espy was personally well known in Cincinnati, where he died in 1857. The merchants of that enterprising city had long been accustomed to secure special weather telegrams to guide them in their business operations, and every one responded to Mr. Gano's endorsement of the

idea of a local, and, eventually, a national work for the benefit of the whole community. Mr. Gano retained to the last his position as a delegate from Cincinnati to the annual meeting, at Washington, of the National Board of Trade, and it is but a few weeks since he was here to congratulate us on the extended usefulness of the Weather Bureau.

CLEVELAND ABBE.

WASHINGTON, January 17, 1898.

CURRENT NOTES ON PHYSIOGRAPHY.

TRANSVERSE ALPINE VALLEYS.

E. RITTER, of Geneva, assistant on the Geological Survey of France and author of special studies on the region of Mt. Blanc, presents the results of his researches on the origin of the location of water-courses, with special reference to the transverse rivers of the western Alps (Le Globe (Geneva), XXXVI., 1897). He discards the theory of an origin along faults, as advocated by Daubrée on the basis of experiments but without local confirmation, and announces a close relation between the transverse valleys and a number of 'orthogonal synclines' or transverse sags in the axes of the folds into which the strata of the region have been compressed. The depression of the sags amounts to 1,000 meters in some instances, as determined by measures of the altitudes of geological horizons. The Arc, Isère, Arve and Rhone are said by Ritter to be examples of transverse rivers thus located; these rivers would, therefore, be classed as transverse consequents. They gather many longitudinal branches from within the mountains, some of these being on synclines (longitudinal consequents), some on monoclines (longitudinal subsequents), and some on anticlines. For the latter it is suggested that a shallow syncline on the crest of the anticline may have served as of temporary guide, the stream having now cut down so deep that nothing but anticlinal structure is visible. Such an explanation hardly recognizes the generality of the problems involved. A river thus perched on an arch would soon be cut to pieces by the branches of its neighbors in the troughs, unless the core of the arch were weak enough to allow it to cut down its valley very rapidly; and in the latter case a valley would be spontaneously developed along the axis of the arch even if no shallow syncline had ever been formed on its crest. The anticlinal streams are, therefore, probably longitudinal subsequents, and the drainage as a whole is partly consequent upon surface deformation, partly adjusted to the internal structure.

PHYSICAL GEOGRAPHY OF NEW YORK.

THE second article under this heading, by R. S. Tarr, discusses the mountains of the State (Bull. Amer. Geogr. Soc., XXIX., 1897, 16–40), and brings clearly to light the strong contrasts of the several mountain groups there included. Especial attention is given to geological structure as affording explanation for differences of form, as such as prevail between the even-topped Highlands, the massive Adirondacks, the linear Alleghenies and the benched Catskills. It is to be feared that, from brevity of form, misapprehension may follow from the statement that, while the Himalayas and Alps are like the Appalachians in origin and rock structure, they are 'not sufficiently mature' to be like them in form; but 'given time, they will become so.' The reader can hardly avoid inferring from this statement that the simple continuation of destructive processes will, in time, transform the other mountain ranges into an Appalachian topography. Only by re-reading other parts of the article can it be understood that the Alps and Himalayas must pass to old age and then by elevation (and not by time alone) enter a new cycle,

in whose maturity their ridges may have even crests, like those of the Alleghenies. So a statement in an earlier paragraph, 'The Adirondacks rose as an insular land area in the earliest Paleozoic sea,' may unfortunately confirm the prevailing error that the Adirondacks were lifted out of water in the earliest Paleozoic sea, in spite of the preceding clause to the effect that they were first elevated in Archean time. The conclusion that the Adirondacks sank as an insular land in the Paleozoic sea is not presented.

PLATEAUS, TABLELANDS AND BASINS.

AN article on the Topography of Mexico, by H. M. Wilson, with a hypsometric map (Bull. Amer. Geogr. Soc., XXIX., 1897, 249–260), presents an account of the desert plains of the interior, including the following statement: "According to common belief, Central Mexico consists of a vast plateau. In fact, it is a great basin or depression, ribbed with many irregularly disposed or disconnected mountain ranges, buttes and isolated ridges, which are separated by broad valleys and plains. Many of these plains are the beds of ancient lakes, like those of Salt lake or Humboldt valley in Utah and Nevada, and have no drainage outlet to the sea" (p. 252). The objection here implied to the use of the term, plateau' is not valid, if a comparatively even surface at a considerable elevation is all that is required to make a plateau; for Mexico has plenty of that sort of surface; nor is the discontinuity of the plains a sufficient reason for placing them outside of the class of plateaus, inasmuch as many accepted plateaus are discontinuous, either from the addition of volcanic cones, the survival of residual mountains, or the excavation of canyons and valleys. Tableland or table mountain is an inappropriate name for an elevated region with still higher borders, although fitting for such great cliff-edged plateaus as those trenched by the Colorado canyon, or for such huge plateau remnants as Roraima and Kukenam, in Guiana. Mesa is limited to smaller examples of uplands with precipitous borders on one or all sides. Basin is already used too indefinitely; being applied to ocean basins, river basins and lake basins, as well as to these arid depressions, floored over with accumulating waste from their higher rims. Penck has lately introduced the German word *Wannen* to replace the indefinite *Becken*, for depressed areas with centripetal drainage. *Bolson* is a Spanish-American term quoted by Hill as locally applied to the intermont depressions of the Mexican region. The curious thing in all this is that English-speaking geographers have no simple name with which to designate this well characterized class of land forms.

W. M. DAVIS.

CURRENT NOTES ON ANTHROPOLOGY.

THE BLACK RACE.

A SUCCINCT exposition of the ethnography of the black race is given by Professor Hamy in *l'Anthropologie*, Vol. VIII., p. 257, sq.

It embraces one-tenth of the human species (about 150,000,000); and of this, one-tenth again (1,500,000) has existed outside of Africa, in Melanesia, etc., from a period when those numerous islands were part of the Asiatic continent.

In Africa, within five degrees north and south of the equator, is the territory of the dwarfs, probably once stretching nearly across the continent. North of this, on both sides of Lat. 15° north, and from the Nile to the Atlantic, are the groups of pure blacks, of average stature, nearly all agricultural, and with a knowledge of iron from a remote date. South of the dwarfs are the Bantu peoples, extending from ocean to ocean, with notable physical differences,

but united by identity of language. The Bushmen and Hottentots in the far south form a separate group, with individual characteristics. But the whole race is distinguished from others by the combination of a dark skin and crisped hair.

ETHNOGRAPHY OF TUNIS.

Few portions of northern Africa are as interesting for the historian and ethnographer as Tunisia. There Carthage was situated and extended her powerful sway far inland, and thither Homer leads Ulysses to find the lotos-eaters.

The most thorough student of its ethnography, both past and present, is Dr. L. Bertholon, of the city of Tunis. He has published a number of memoirs of marked value, notably a *résumé* of the anthropology of Tunisia (1896), and anthropological exploration of Khumidria and the island of Gerba, the latter being the scene of the Homeric lotophagi (*L' Anthropologie*, 1897).

In the *Revue Tunisienne* (October, 1897) he sums up the evidence to show the European origin of certain elements of the Berber population of north Africa, from the ancient race of Europe represented by the Cro Magnon type. In supporting this thesis he calls to his aid both the survivals of the type in the present population and the information contained in Egyptian inscriptions and classical writers.

THE CHULTUNES OF LABNA.

Labna is one of the ruined cities of Yucatan, and a *chultun* is the Maya name for a peculiar kind of chamber, constructed ten or fifteen feet below the surface and communicating with it through a well-like opening. They are common elsewhere in Yucatan and were described by the traveler Stephens in his familiar books. Some of them have finely polished, stuccoed sides, while others are roughly finished. Those at Labna are described with care by Mr. Edward H. Thompson in the 'Memoirs of Peabody Museum,' Vol. I., No. 3 (Cambridge, 1897).

By some they have been considered granaries, by others water reservoirs. Mr. Thompson found in many of them human bones, stone implements and pottery. Those remains he inclines to believe are not indicative of the original intention of the chambers, but were, for some obscure reason, placed in the reservoirs when their original purpose was abandoned.

D. G. Brinton.
University of Pennsylvania.

NOTES ON INORGANIC CHEMISTRY.

At the recent meeting of the American Chemical Society in Washington attention was called to the fact that much of the best work now being done on atomic weight determinations is by American chemists. In this work Professor Richards, of Harvard, stands in the front rank, and his latest work is of great importance. In the Proceedings of the American Academy he has published, in connection with Mr. A. S. Cushman, a revision of the atomic weight of nickel, and, in connection with Mr. G. P. Baxter, a revision of the atomic weight of cobalt. The atomic weights of these two metals are of unusual interest, because, according to most determinations, that of cobalt is greater than that of nickel, while from its position in the periodic system the reverse would seem to be demanded. The late Professor Krüss attributed the discrepancy to impurities in the metals used by previous experimenters, and isolated from them what he supposed to be a new metal, 'gnomium,' whose existence has never been confirmed. Professor Richards' results are of decided comparative value, inasmuch as the same compound—the bromid—was used of both metals, and the analyses were carried out by exactly the same process. The metals were most carefully purified, but little variation was found

in the analysis of samples which had been purified to an extreme degree and those in which the purification had not been carried quite so far. Thus, no evidence was found showing the presence of any other element or any impurity in the nickel bromid and cobalt bromid used. The figure obtained for the atomic weight of nickel is 58.69, and for cobalt 58.99, and the results of former observations as to the anomalous order of these elements in the periodic system are confirmed. An explanation of the anomaly is not forthcoming, and the same may be said regarding the atomic weight of tellurium. Further work upon the atomic weights of nickel and cobalt involving the use of other compounds than the bromid are now in progress in the Harvard laboratory.

A RECENT number of the *Journal* of the Society of Arts contains an extended article by Thomas Bolas on arsenical poisoning by wall papers, etc. After pointing out that the work of Gasio and Emmerling has conclusively shown that certain moulds have the power of living on arsenical paper and forming volatile arsenic compounds, the author points out that arsenic even in small quantities is poisonous to these moulds and that the throwing off of arsenic in a volatile form may be an effort of nature to cast out the poison. Further, the most dangerous papers may be those which contain mere traces of arsenic, as when a large quantity is present the moulds themselves could not live. He suggests that traces of arsenic may come into wall papers from the imperfect washing of the vessels used to contain the more highly arsenical colors, and states that dyed and printed fabrics now very frequently contain traces of arsenic. He recommends the use of the precipitated borate of copper as a green pigment to replace arsenical greens, as long ago proposed by Bolley. In view of the present low price of boric acid, this pigment could be used commercially.

A NOTE in a recent number of the *Chemical News* by Percy A. E. Richards calls attention to the presence of zinc in a water which, after being stored in a reservoir, was conveyed to a private residence through a galvanized iron pipe some two miles long. The amount of zinc bicarbonate in the water was 7.3 parts per 100,000 or 73 milligrammes per liter. In the following number of the same journal Dr. T. L. Phipson makes note of the presence of zinc in a sample of water which was conveyed into the town of Funchal, island of Madeira, through galvanized iron pipes. Dr. Phipson remarks that, 'as zinc is a metal whose compounds have a noxious action upon the economy, it is evident that galvanized iron pipe cannot be used with safety to supply water for drinking.' It would seem probable that the large amount of zinc in the water described by Mr. Richards (more than half a grain in a pint) would have a decided effect upon the health, though zinc is probably far less injurious than several other metals occasionally present in drinking water. The distance the water was conveyed and the probability of its relatively slow passage through the pipes would account for the large quantity of zinc present.* Where only short lengths of galvanized iron pipe are used there would be far less danger, but the subject deserves further study.

Among recent articles on calcium carbid and acetylene is one by Lunge and Cedercreutz in the *Ztsch. Angew. Chemie* on their analysis. The gas from ordinary calcium carbid contains up to four per cent. of impurities; among them hydrogen sulfid and phosphin are the most important. These are very injurious, and the gas may be puri-

* An account of a very similar case to that reported by Mr. Richards is given in the London *Lancet* for March 1, 1884, as occurring in the water supply of the village of Cwmfelin, Wales.

fied from them by passing through a solution of bleaching powder, which readily oxidizes them. The amount of acetylene furnished per kilogram of commercial calcium carbid should be not less than three hundred liters. According to Fuchs and Schiff in the *Chemiker-Zeitung*, two samples of the Neuhaüser carbid gave, the one 286.8, and the other 297.6 liters per kilo.

J. L. H.

SCIENTIFIC NOTES AND NEWS.

SURVEYS OF FOREST RESERVES.

In response to a resolution adopted December 15th, the Secretary of the Interior has transmitted to the Senate a report, prepared by the Director of the U. S. Geological Survey, of the operations of the survey in carrying out those provisions of the last Sundry Civil Act which relate to the survey of the public lands which have been or may hereafter be designated as forest reserves.

The report goes into the subject of organization of the work under the several branches, the characters of the land to be surveyed, progress and results, etc. To the date of the report more or less work had been done in nine reserves—the Black Hills, the Big Horn, the Teton, the Uinta, the Bitterroot, the Priest River, the Washington, the Lewis and Clarke, and the Flathead. The work consists of (1) a topographic and subdivision survey, and (2) an economic examination of the forests of the areas. The surveys comprise base-line measurement, triangulation, detailed topography, including the sketching of all timber areas on the map, leveling and the placing of permanent bench-marks, and land subdivision surveys. The examination of the forests comprises the study of the distribution of forest areas and woodlands, the size and density of the timber, and the distribution of species, the ravages of forest fires, the extent of pasturage and its effects and the extent of timber already cut. The report shows that the progress made in the work as a whole was not as great as had been anticipated, this being especially true of the surveys, and also that a large proportion of the appropriation is still unexpended. There are two reasons why the progress has not been greater: first, the fact that the work was not started until very late in the season and was thus greatly hampered by storms and cold; and, second, the extremely rugged and density-timbered character of the country under survey. Professor Walcott reports in detail the progress made in the few weeks in which work was done. It is hoped, with the coöperation of Congress, to resume operations early in the spring and make a full season in these reserves.

W. F. M.

GENERAL.

The Bruce gold medal of the Astronomical Society of the Pacific Coast has been awarded to Professor Simon Newcomb, of Washington, D. C., for his distinguished services to astronomy. This is the first award of the medal, to the establishment of which we some time since called attention.

Representative Wheeler, of Alabama, has introduced a joint resolution to fill the vacancies in the Board of Regents of the Smithsonian Institution by the appointment of Mr. Alexander Graham Bell, to succeed Mr. Gardiner G. Hubbard, deceased, and the reappointment of Mr. John B. Henderson and Mr. Wm. Preston Johnston, whose terms expire January 26th.

M. Wolf succeeds M. Chatin as President of the Academy of Sciences, Paris, while M. Van Tieghem, the botanist, has been elected Vice-President in the place of M. Wolf.

At its meeting on January 12th the American Academy of Arts and Sciences elected John M. Coulter, of Chicago, and Douglas H. Campbell, of Palo Alto, as Associate Fellows in the Section of Botany, and Elias Metschnikoff, of Paris, as Foreign Honorary Member in the Section of Zoology and Physiology.

A banquet in honor of Professor Virchow's fiftieth anniversary as a university teacher and as editor of the *Archiv für pathologische Anatomie* was given at Berlin on December 28th. Speeches were made on Professor Virchow's services as a teacher and man of science by Professors Waldeyer and Liebreich, and Professor Virchow replied.

The memorial meeting in honor of the late

Gardiner Greene Hubbard was duly held in Washington on January 21st, in accordance with the arrangements that we had previously announced. Mr. Alexander Graham Bell presided, and addresses were made in behalf of the different institutions and scientific movements in connection with which Mr. Hubbard was prominent. The speakers were Surgeon-General George M. Sternburg; Professor S. P. Langley; President W. L. Wilson, of Washington and Lee University; President B. L. Whitman, of Columbian University; President D. C. Gilman, of Johns Hopkins University; Dr. Marcus Benjamin, Major J. W. Powell, Mr. A. W. R. Spofford and General A. W. Greely.

WE regret to record the following deaths among men of science: Professor Ernst Ludwig Taschenberg, known for his contributions to popular economic entomology on January 20th, at the age of seventy-nine years; Dr. Necker, Privatdocent in astronomy at Königsberg, who died at Cairo, as the result of an accident on December 23d, aged thirty years; and M. Ernst Bazin, inventor of the roller steamer, for which much has been claimed.

CABLEGRAMS to the daily papers report that the weather was extremely favorable for the various parties observing the total eclipse of the sun in India on January 22d. Fuller information must be awaited before any details can be given, but it is expected that the photographic results will be especially valuable.

THE German Association of Men of Science and Physicians will this year hold its annual meeting in Leipzig, under the presidency of Professor Waldeyer.

A LOCAL reception committee has been formed in Cambridge for the fourth International Congress of Zoology, which opens on August 23d, with Professor Newton as chairman and Mr. Adam Sedgwick as vice-chairman.

THE International Fishery Congress convened at Tampa, Fla., on January 19th, with delegates from nearly all the States and from several foreign countries in attendance. There were present a large number of men of science, and important papers were promised in the program. We hope to give, in a subsequent number, a report of the scientific work of the Congress.

THE following item from the Martinsburg *Democrat* should be of interest to the President of the United States and to Senator Elkins: "Between the hours of 8 and 9 o'clock on Tuesday night last, people residing in the neighborhood of King and Raleigh streets were startled by a war of words between George M. Bowers and his brother, John S. Bowers, who are not on amicable terms. The wordy contest soon resulted in a fisticuff, in which a severe wound was inflicted by George M. Bowers upon his brother, extending almost from ear to ear. So severe was the injury that the services of Dr. Morison were required to dress the wound, as the injured brother bled profusely. No arrests were made. This is the same gentleman who is a candidate for Fish Commissioner of the United States."

THE Committee of the French Chamber of Deputies appointed to consider the organization, at the Exposition of 1900, of a section for universities and high schools has reported, urgently recommending such a section, to be called 'Section of Science and Letters.'

THE Geological Society of London will this year award its medals and funds as follows: The Wollaston medal to Professor F. Zirkel; the Murchison medal and part of the fund to Mr. T. F. Jamieson; the Lyell medal and part of the fund to Dr. W. Waagen; the balance of the Wollaston fund to Mr. E. J. Garwood; the balance of the Murchison fund to Miss J. Donald; the balance of the Lyell fund to Mr. Henry Woods and Mr. W. H. Shrubsole; and a part of the balance of the Barlow-Jameson fund to Mr. E. Greenly.

AT a meeting of the managers of the Royal Institution, held on January 6th, Professor E. Ray Lankester was elected Fullerian professor of physiology in the place of Professor Waller. If nothing has interfered with the program Professor Lankester began on January 18th a course of eleven lectures at the Institution on the 'Simplest Living Things.' On January 20th Professor Dewar will deliver the first of a course of three lectures on the 'Halogen Group of Elements,' and on January 22d Professor Patrick Geddes began a course of three lectures on 'Cyprus.' The Friday even-

ing meetings of the members were to be resumed on January 21st, when Sir John Lubbock, Bart., M.P., delivered a discourse on 'Buds and Stipules.'

The subjects and dates of the lectures to be given at the Teachers' College, New York, by Professors James and Shaler, of Harvard University, have now been arranged as follows: Professor James will lecture on 'The Gospel of Relaxation,' at 3:30 p. m., on January 28th, and Professor Shaler on 'The Use of the Environment in Education,' at noon on February 19th.

The Scientific Society of Bridgeport, Conn., has been given a large collection of birds and cells gathered some time ago by Rev. Mr. Linsley.

It is stated in the *Athenæum* that MM. H. Lachambre and A. Machuron are going to issue an illustrated account of the making and equipping of M. Andrée's balloon and of his first attempt to start in 1896, which was frustrated by bad weather, as well as of his actual disappearance into the unknown in 1897. The authors accompanied M. Andrée to Spitzbergen, the one in the former year, the other on the later occasion. The book, which contains a brief biography of M. Andrée, is to be published in England by Messrs. Constable. The same firm is to bring out Mr. Trevor Battye's new book, 'A Northern Highway of the Czar.'

Messrs. A. & C. Black will publish the lectures given by Dr. D. H. Scott at University College, London, last year, under the title 'Studies in Fossil Botany.'

The *American Journal of Pharmacy* has issued an appeal for subscriptions in the United States towards a fund for the erection of statues in Paris to M. Pelletier and M. Caventon, the discoverers of quinine and strychnine.

Dr. Elliott Coues has been offered a position on one of the committees of the forthcoming International Zoological Congress, and intends being present at Cambridge.

The U. S. Civil Service Commission announces that an examination will be held on February 23, 1898, at Washington, D. C., and other places throughout the United States for the position of assistant microscopist in the Department of Agriculture. This examination will consist of a very light educational test, together with practical questions on the use of the microscope. The microscopical inspection service under the Department of Agriculture has been greatly extended, and vacancies are to be filled in sixteen different cities. Only women are eligible for this position.

The American Geographical Society held its annual meeting on January 17th, at Chickering Hall, New York, when the following officers were elected by unanimous vote: Ex-Judge Charles P. Daly, President, to act for one year; Egbert L. Viele, Vice-President, to act until 1901; W. R. Jones, Treasurer, to act until 1899; Anton A. Raven, Recording Secretary, to act until 1901; L. Holbrook, M. K. Jessup, Gustav A. Kissell, John A. Haddon and Henry Paush. Rev. Dr. C. C. Tiffany presided over the meeting. Forty-eight new members were elected, bringing the membership up to 1,187. The committee appointed to consider the erection of a new building reported that, while the present building at No. 11 West 29th Street is too small, the funds of the Society would not permit of the erection of a new building at the present time.

Unsuccessful attempts have been made in St. Louis and in Milwaukee to repeat the operation of total exsection of the stomach, successfully carried out by Dr. Schlatter.

The bubonic plague continues unabated in India; influenza is epidemic in London, and there has been a serious outbreak of typhoid fever in Philadelphia, due, it is thought, to the breaking of a sewer and the emptying of its contents into the water supply of the city.

The St. Petersburg Institute of Experimental Medicine held its annual meeting on December 20th, at which an address on the bubonic plague was delivered by M. Wladimiroff, and a report was presented by the Director of the Institute, Dr. Lukjanoff. It was stated that 120 persons had been engaged in research at the Institute, and that sixty-five investigations had been published. Three hundred and sixty-three persons had been treated for hydrophobia by antirabic inoculations, with a mortality of 0.7 per cent. and 25,000 tubes of anti-diphtheria serum had been supplied.

As we have already announced, the ninth

International Congress of Hygiene and Demography will be held at Madrid from April 10th to April 19th. The hygienic work of the Congress will be divided among ten sections, as follows: Microbiology in Relation to Hygiene; Prophylaxis and Transmissible Disease; Medical Climatology and Topography; Urban Hygiene; Hygiene of Alimentation; Hygiene of Infancy and of Schools; Hygiene of Exercise and Labor; Military and Naval Hygiene; Veterinary Hygiene, Civil and Military; Sanitary Architecture and Engineering. The part of the work relating to Demography will be divided among three sections, as follows: Technics of Demographic Statistics; Statistical Results in Relation to Demography; Dynamical Demography (movements of population, etc). The Secretary-General of the Congress is Dr. Amalio Gimenoy Cabañas, professor of hygiene in the University of Madrid, and the President of the Executive Committee is Professor Julian Calleia.

THE want of an independent water supply for the Zoological Gardens of London has been felt for many years by this institution, and recently it was decided to put down an artesian bored tube well. The results have been, as was anticipated, the tapping of powerful springs of pure water in the chalk at the depth of 450 feet, yielding 240,000 gallons per day.

A DEPARTMENT for hydrophobia—similar to the Pasteur Institute in Paris—is to be added to the Institute for Infectious Diseases in Berlin, of which Robert Koch is Director.

A DISPATCH to the daily papers from Montreal states that Mr. McCreary, the Immigration Commissioner, has taken over the herd of buffaloes which Lord Strathcona has presented to the Dominion government, to be placed in the National Park at Banff. There are seventeen animals in the herd, all thoroughbreds but one. The herd will be kept at Silver Heights, Lord Strathcona's estate, near Winnipeg, until April, when they will be sent to Banff, where they will be placed in an enclosure of forty acres, now being prepared for them.

BEFORE the members of the Drawing Room at the Waldorf-Astoria, Professor Willis L. Moore, Chief of the U. S. Weather Bureau, recently delivered a lecture, in which, according to report in the New York *Tribune*, he pointed out that the practical application of science to the industry of the world was nowhere more fitly illustrated than in the extensive and various uses made of the present weather service of the United States. Briefly referring to some of the more striking instances of the Bureau's utility, its Chief showed that the great raisin interests of California cured their fruit according to the weather reports, and nearly all the important vineyards were in telephonic communication with some central point from which forecasts of rain were distributed. On the high plains of Montana, Colorado and the western slope, Mr. Moore continued, the vast cattle interests herded their flocks on the first warning of a coming blizzard, and hundreds of cattle were annually saved by reason of the forewarning of the greater number of destructive cold waves. On the Great Lakes the destruction of life and property was but a small percentage of what it was fifteen years ago, due to the fact that to-day the mariners were students of the weather map, and the warnings of the Weather Bureau accurately foretold nearly all storms destructive to commerce.

A TABLE has been prepared by Rev. C. T. Ward, of New York, showing the amount of money left for benevolent purposes by testators throughout the united States during the past three years. The bequests amounted to $14,374,800 in 1897, $13,112,300 in 1896 and $9,401,500 in 1895. The money bequeathed for educational purposes last year amounted to $5,292,200.

PROFESSOR W. L. ELKIN, Director of the Observatory of Yale University, in his annual report for the year 1896–7, states that while in Europe in 1896 he purchased a third Voigtländer lens and one by Hermagis, both of six inches aperture, and since his return has procured two other similar ones of American make, thus making six cameras available on the mounting. The cost of all three of the Voigtländer lenses has been generously defrayed by Cyprian S. Brainerd, Esq. Five lenses were put in use in August last and eight meteor trails, five of them Perseids, were secured. The

November and December periods were, however, unproductive this year. Dr. Elkin has employed a considerable part of his time in the measurement and discussion of the photographic trails of the Perseids thus secured, now numbering 17 in all. So far, the results are not very conclusive as to the character of the radiant, but as each year will add to the data there seems good reason to hope ultimately for most valuable deductions. Mr. John E. Lewis has rendered valuable cooperation in this work, though he did not secure any trails at Ansonia. During the winter a portion of the work on the parallaxes of the ten first magnitude stars in the northern hemisphere, comprising the observations and reductions, was passed through the press. Dr. Chase was absent in Europe on leave from July, 1896, to January, 1897. Since his return he has taken up the Heliometer work on the parallaxes of large proper motion stars. During his absence the time service was under the care of Mr. George K. Lawton until October, 1896, and subsequently under that of Dr. B. W. McFarland. Dr. Palmer has been engaged in computations, mainly of refraction corrections and tables therefor. Miss Newton has been occupied in preparing a series of references to other catalogues in an interleaved copy of the Bonn Durchmusterung.

Mr. T. Whitburn, the President of the Guildford Natural History and Microscopical Society, writes to the London *Times* to say that on August 23d he addressed a letter to the African explorer and naturalist, Mr. F. C. Selous (who has a residence and museum near Guildford), informing him of the proposed petition for the preservation of Wolmer, and requesting his support. He also inquired if Mr. Selous would join the Society as an honorary member. The reply of Mr. Selous is as follows: "Allan Line Royal Mail Steamers.—Steamship Laurentian, Dec. 11, 1897.—Dear Sir.—I have been away in the Rocky Mountains, and only received your kind letter of August 23d the other day, on my return to Canada, on my way home. Although I have killed a great many wild animals, I have never destroyed life wantonly, and I think that I can fairly claim to be more of a naturalist than a sportsman. Besides having secured some very fine specimens of African big game for the South Kensington and South African Museums, I have also made large collections of butterflies and beetles (amongst which were many new species), all of which are now in the South African Museum at Cape Town. I trust that your Society will be successful in securing Wolmer Forest as a sanctuary for wild birds and animals, and I shall be very pleased to have my name added to your requisition. I shall also consider it a great honor to be made an honorary member of your Society, and will try and get in touch with you as soon as I come to live at Worplesdon, as I shall do sooner or later. Believe me, dear sir, yours very truly, F. C. Selous."

According to the *Electrical World*, the value of the instruments and machinery during 1897 for scientific purposes exported from the United States was $3,054,453, which was an increase of half a million dollars as compared with the exports in 1896.

A general meeting of the Aëronautical Society of Great Britain, at which Sir Charles Warren presided, was held in the rooms of the Society of Arts on December 16th, when several forms of flying machines were exhibited and described. The report in the London *Times* states that Major Moore showed a machine in which he aims at reproducing the motions of a bird in flight, and Mr. S. Bruce explained how his signalling balloons might be found useful to Arctic explorers. The application of kites to the preservation of life was illustrated by the apparatus of Captain Spiers, who considers that the simplest way of carrying a line from a wrecked ship to the land is by means of a kite. Captain Baden-Powell, the Secretary of the Society, exhibited a specimen of the kites he employs for man-lifting purposes. He said that as a rule four or five kites 12 feet long were sufficient to lift a man, though in a very strong wind he had been raised off his feet by one. In America kites had been used for meteorological purposes, and experiments had been made with them for military purposes. He thought it a pity they had not been employed in the operations in India. Mr. Pilcher showed one of his soaring machines in which

he had been able to cover nearly 300 yards. He is now at work on a four-horse power oil engine, to weigh about 40 pounds, which he intends to fit together with a five-foot screw propeller to one of these machines; he hopes then to have a genuine flying machine. Captain Baden-Powell described an aluminum balloon, fitted with a Daimler oil-motor, which had recently been tried at Berlin with somewhat qualified success, and after a few remarks from the chairman on the military aspects of flying machines, the proceedings terminated with a vote of thanks to those who had brought forward exhibits.

UNIVERSITY AND EDUCATIONAL NEWS.

PRESIDENT HARPER says in his twenty-first quarterly statement that it is the custom of the Board of Trustees to arrange for the expenditures of a particular year six months before the beginning of that year. In accordance with this custom the Trustees, on December 29th, voted the budget for the year beginning July 1, 1898. The assured income of the University from all sources was estimated at $529,000. In addition to this amount the founder of the University, Mr. Rockefeller, has been kind enough to designate, under certain conditions, the sum of $200,000, making in all $729,000. The expenditures of the various divisions of the University and of the various departments have been adjusted to this estimated income. The sum of $25,000 has been set apart as a contingent fund and the remainder is distributed as follows:

Administration and General Expenses,	$72,875
Faculty of Arts, Literature and Science,	347,767
The Divinity School,	49,516
The Morgan Park Academy,	37,120
University Extension Division,	41,064
Libraries, Laboratories and Museums,	44,615
Printing and Publishing,	41,560
Physical Culture,	7,500
Affiliated Work,	3,000
Buildings and Grounds,	59,425

THE number of graduate students in arts and science in several leading universities are given by the *Harvard Graduates' Magazine* as follows: Harvard, 268; Yale, 254; Johns Hopkins, 220, and Columbia, 207. The number at Chicago appears from President Harper's recent statement to be larger than in any other American university, namely, 324, of which 202 are men and 122 are women.

DURING the present winter semester the registration of regular students in Berlin University amounts to 5,921. This is the largest registration in ths history of the University, being 400 in excess of last winter.

PROFESSOR JAMES E. RUSSELL, of the department of Education in the Teachers' College, New York, has been appointed Dean of the College and will, with Dr. F. S. Baker, of the department of English, represent the College on the Council of Columbia University.

THE Academy of Sciences, Paris, has recommended M. C. Chatelier, professor of chemistry in the School of Mines, and M. Joannis, lecturer at the Sorbonne, as candidates for the chair of mineralogical chemistry in the Collège de France, vacant by the death of M. Schützenberger.

M. GUIART has been given charge of the practical work in natural history under the Faculty of Medicine in the University of Paris.

MR. ALFRED HOPKINS, Q.C., M.P., has been elected Principal of Owens College, Manchester, in succession to Dr. Ward, resigned. Mr. Hopkins has announced his attention of retiring from Parliament.

DR. JULIUS ISTVÁNFFY has been appointed professor of botany in the University of Klausenburg, and Dr. Alexander Mágocsy-Dietz associate professor of botany in the University of Budapest. Dr. Ambronn and Dr. Rhumbler, docents in astronomy and zoology in the University of Göttingen, have been promoted to professorships. M. Benard has been appointed assistant in physics at the Collège de France, succeeding M. Maurain.

DISCUSSION AND CORRESPONDENCE.

CLIMATIC CONTRASTS ALONG THE OROYA RAILWAY.

TO THE EDITOR OF SCIENCE: Much has been written concerning the wonderful engineering necessary in order to construct the Oroya Railway, and concerning the scenery along its line, and every one is more or less

familiar with the main facts in the history of this, 'the highest railway in the world.' There is, however, one feature which the traveller who makes the trip from Lima to Oroya, over this wonderful road, cannot fail to notice, and yet which has scarcely been noticed in previous accounts. This concerns the climatic contrasts that are exhibited between the beginning of the line at Callao and its terminus at Oroya, 12,178 feet above sea level. The writer was so struck with these climatic changes during a recent trip over the railroad that he is tempted to send a hurried note concerning them to SCIENCE.

There is nowhere else in the world an opportunity like that permanently afforded by the Oroya Railway of travelling from sea level to an altitude of nearly 16,000 feet in eight hours in a comfortable railway carriage. Many tourists make the great mistake of going only part of the distance to Oroya, and they thus lose some of the most striking features in the climatic belts through which the road passes. Starting from sea level at Callao, the road runs through Lima up the fertile valley of the Rimac, where sugar cane and cotton growing on all sides recall the sugar and cotton plantations of our own Southern States, and bear witness to the genial climatic conditions which here prevail. The contrast, in this section, between the dry and barren hills above the valley and the fertile valley bottom itself, where the lack of rainfall is made up for by irrigation, is most striking.

Chosica, 2,800 feet above sea level, is the point at which the railroad was left and mules were taken in making the ascent of Mt. Harvard, occupied by Professor S. I. Bailey and his party in 1890 as a temporary station, before Arequipa was selected as the permanent site of the Southern Station of the Harvard College Observatory. Mt. Harvard, 6,600 feet above sea level, situated midway between the belt occupied by the 'coast cloud' and a cloudy and rainy region further inland, offered favorable opportunities for astronomical work, but was replaced by Arequipa, where the conditions are still more favorable.

Further up the line, at San Bartholomé, 4,959 feet in elevation, there comes a small belt of country where sugar cane and cotton no longer grow, but where fruit trees thrive. Bananas, apricots, limes, *chirimoyas*, *paltas* and other fruits are offered for sale in great quantities at this station, and are also sent down to the Lima market. San Bartholomé is also known —in this case unfavorably—as the chief seat of the disease known as *verrugas*, which, although not yet carefully studied in this region in connection with its dependence upon meteorological conditions, would seem, according to information given the writer, to be closely related to these conditions. *Verrugas*, which appears to be a species of blood poisoning, is usually less fatal to the natives of the region than to foreigners. During the construction of the railroad at this point a special hospital had to be built to accommodate the engineers and laborers, who fell victims to the disease. *Verrugas* is generally believed by the natives here to be milder and less prevalent in years when there are few cloudbursts, and more common and more severe in years of many cloudbursts. The disease is always most prevalent after the rainy season has begun.

In this region some rain is said to fall every year on the mountains, but the annual rainfall is reported to be very small, indeed, until above Matucana (7,788 ft.), where the increasing elevation provokes increased precipitation. Cloudbursts, or *huaicos*, as they are here called, occur anywhere on the mountains, at intervals of a few or of many years. These *huaicos*, which seem to be similar in every way to the cloudbursts of our southwestern country, do great damage to the railroad line, especially to the bridges and embankments across the (usually) dry ravines, or *quebradas*. They come very suddenly, and bring down great quantities of rocks and sand from the mountain sides. It was a *huaico* of this kind that carried away the famous Verrugas bridge a few years ago. Landslides are not uncommon in connection with the *huaicos*. A rainy season here comes from December to April. At Casapalca (13,606 ft.) the rain falls mostly in the afternoon, and snow, when it falls, comes usually late in the afternoon. The rain is said to begin earlier and earlier in the day as the rainy season comes on, this apparently being the result of the increasing activity of convectional

ascent as the sun comes more nearly over this parallel of latitude. There is a common belief at Casapalca that there is less snowfall at that town than in former years, and a greater number of *huaicos*, but this, if true, is undoubtedly only another case of a periodic change in climatic conditions, which may last a few years and will then be followed by some years of the reversed conditions.

Mention has been made of the change from the sugar and cotton belt to the fruit belt. In ascending the valley from San Bartholomé the fruit district is soon left behind, and the San Mateo (10,534 ft.) is the center of a region singularly adapted to the growth of potatoes. Here the mountain sides are covered with terraces, most of them built in very ancient times, and potatoes are grown to considerable altitudes above the valley bottom. The increasing rainfall in this region results in a considerable growth of grass and some low shrubs on the mountain sides, whereas nearer the sea level, as above noted, the slopes are bare, and farther up the snow lies on the mountain summits throughout the year. On his journey over the Oroya the writer encountered the first rain noted during the trip at 3 p. m., at an altitude of about 13,000 feet above sea level, and another shower came at 4 p. m., at an altitude of over 14,000 feet.

At the Galera Tunnel, 15,665 feet, the highest point reached by any railroad in the world, considerable snow fields were seen at about the same height above the sea as that of the tunnel, and isolated patches of snow were met with somewhat below that elevation. At this point any cultivation of the ground is, of course, out of the question. From the Galera the descent is rapid down the grass-covered slopes of the mountain into the valley in which Oroya is situated, and here again we reach a climatic zone where it is possible to raise potatoes and other farm products. One can thus travel by the Oroya Railway from fields of sugar-cane and cotton, through a belt where fruit grows most luxuriantly, and up higher to a district famous for its potatoes, until, after winding around slopes and through tunnels, at an altitude where nothing but grass grows, the snow line is reached, and a descent is made to a region where the rigorous climate of 16,000 feet is replaced by those more genial conditions which favor the raising of crops. This whole succession of climates can be passed through in the short space of ten hours, and it is this feature of the Oroya road which it seems to the writer has not been sufficiently emphasized. The climatic lesson which such a trip teaches is one which is well worth learning, even at the risk of a touch of *soroche*, or mountain sickness, which comparatively few persons escape at the highest part of the road.

A rather interesting industry, which was distinctly the result of climatic conditions, was attempted a few years ago in connection with the snow fields on the mountains above Lima. The presence of these large masses of snow and ice in close proximity to the railroad led to the adoption of a scheme to transport these products of the climate to Lima, where they were to be sold to the inhabitants as ice is sold in our own country. A beginning was made, and some ice was thus taken to the city, but there were certain legal and pecuniary complications in the way, and the enterprise had to be abandoned. A reminder of this unsuccessful venture is still to be seen on the list of freight rates from Oroya to Lima, posted at the railway station in Oroya. On this list, together with the rates for the transportation of freight of various kinds, the traveller may see how much it costs to send *snow* from Oroyo to the capital. In Quito the sale of snow and ice brought to the city by the Indians from the high mountains in the vicinity furnishes a similar illustration of the climatic control over human occupations, one of the most important, as it is one of the most striking, subdivisions of the subject of anthropo-climatology.

The climatic contrasts which are exhibited along the Oroya afford an excellent illustration of the variety of climates found in Peru by reason of its high mountains and its geographical position. We learn from Prescott that the Incas were well aware of the differences in the climates of various parts of Peru, and that they were careful to study the climatic conditions to which the tribes they conquered had been accustomed. In transferring, as was often their custom, newly-conquered subjects from their

own district to some other portion of the empire, the Incas made it a point never to oblige people accustomed to a high altitude to live at sea-level, nor to make those who were used to living at a low altitude live far above sea-level. In every case the transfers were made to districts where the climatic conditions were as nearly as possible the same as those to which the conquered people had become accustomed. One of the most interesting contrasts in the climates of Peru is seen in the difference between the desert costal strip of the provinces bordering on the Pacific and the forested Amazonian provinces in the northeast. In the former the dry climate prevents vegetable growth, except where man has provided irrigation, and there must be a constant struggle against Nature in order that anything green may grow. In the well-watered Amazonian provinces, on the other hand, vegetation is altogether too abundant, and man must here struggle to keep down what Nature produces too freely. In fact, the exuberance of the vegetation is such as to interfere with the habitability of the region, for almost as soon as a clearing is made in the forests it is again overgrown. In the rainy provinces, therefore, habitability is almost precluded by the superabundance of vegetation, while in the barren desert strip man can only live where his own labor has provided a water supply sufficient for the needs of vegetation. The contrast is a striking one.

R. DeC. Ward.

Lima, Peru, December 27, 1897.

An Interesting Monstrosity.

My attention was recently called to the monstrosity pictured in the enclosed photograph. It is a cock, of no pure breed, though carrying some Plymouth Rock blood, having no signs of spurs upon the tarsi, but with well developed ones upon the head, on either side of the comb, just above the eyes. These spurs, neither of which is quite normal in shape, are symmetrically placed, and have every appearance of horns. The right spur, which is less malformed than its mate, is fifteen-sixteenths of an inch in length from its perforation of the skin, and about three-sixteenths of an inch at that point, tapering somewhat unequally to a blunted point, the whole curved so as to somewhat resemble the horn of a Texas steer.

The left spur, which in diameter and length would be nearly identical with the right, is bent forward so as to form a nearly complete circle, approximately one-half inch in diameter, the point of the spur being in contact with the base of the comb. Both of the spurs are entirely disconnected with the bony structure of the skull, being attached only to the skin and easily movable in all directions.

I could not ascertain from the owner of the cock, in whose possession it had been but a short time, whether this looseness of attachment was congenital or had been brought about by contact with the coop or by fighting.

What makes this specimen extremely interesting is the fact that it is neither a case of dichotomy nor of supernumerary parts nor of atavism, but one in which the normal part is found in an abnormal position without any vestige of representation in its usual place.

In the limited amount of material at my command, I have been unable to find any accounts of cases in many respects similar to this, although Sutton, in his 'Evolution and Disease' (Contemporary Science Series), mentions the successful transplanting (artificially) of the spurs of cocks to the excised comb. I am awaiting with interest the result of interbreeding this specimen, in the hope that more of its peculiar kind may be secured, from which a fertile variety of monstrosities may be obtained.

Edwin G. Dexter.

Colorado State Normal School,
Greeley, Col.

Correction.

Objection having been made to my use of the term 'respiration' in the article 'Some Considerations upon the Functions of Stomata' in Science, January 7, 1898, page 15, second column, line 12, I wish to substitute for it the expression 'the passage of gases.' Plant physiologists, for very good reasons, wish to restrict 'respiration' to the gaseous exchange which has to do with the catabolic activities of living cells, excluding that exchange taking place in those anabolic activities (known as photosyntax)

by which the plant makes use of carbon dioxide in building up carbohydrates.

CHARLES E. BESSEY.

SCIENTIFIC LITERATURE.

U. S. Geological Survey. Monograph XVIII. The Marquette Iron-bearing District of Michigan, with Atlas. By CHARLES RICHARD VAN HISE and WILLIAM SHIRLEY BAYLEY. Including a chapter on the Republic Trough by HENRY LLOYD SMYTH. 4to. Pp. xxi + 608. Pl. I.–XXXV. Figs. 1–27. Atlas sheets I.–XXXIX. Price, $5.75.

The issue of the above monograph marks the completion of another chapter in the investigation of the ancient crystalline rocks of America. The book presents the fullest solution yet attained of one of the most puzzling and elusive of the many problems confronting geologists. The great economic importance of the region early drew attention to it. First the copper excitement and then the development of the iron interests brought settlers in increasing numbers. The pioneer work of Foster and Whitney established the claims of the rocks upon the attention of geologists, and the long and honorable line of investigators who have devoted time and effort to the understanding of them embraces the names of many of the best workers in this branch of science.

The monograph opens with a preliminary abstract of its contents, in which a reader who cannot well peruse all its pages will find a succinct exposition of what follows. A brief introduction then outlines the larger official reports previously issued, the area to be described, the chief geological classification, the distribution of the principal formations and the broad structural features. In Chapter I., W. S. Bayley presents a thorough bibliography of all previous literature in the shape of abstracts of each paper or reports chronologically arranged. This has been a heavy task, for the literature is extensive (the chapter occupying 148 pages), and the cited articles are difficult ones to sum up concisely. Dr. Bayley has, however, done so not only concisely, but with great clearness and thoroughness. In Chapter II. the same writer discusses the Basement Complex. Much light is thrown on this tangle of metamorphosed eruptives, but no unwarranted hopes of unraveling their stratigraphical relations are encouraged. The Northern Complex is treated under the following subdivisions: The Mona schists, the Kitchi schists, the gneissoid granites, the hornblende-syenite and the intrusives. The Southern Complex is subdivided into the schists, both micaceous and hornblendic, the gneissoid granites, the Palmer gneisses and the intrusives. A few isolated areas are cited within the boundaries of the Algonkian.

In Chapter III., C. R. Van Hise takes up the description of the Lower Marquette series in detail. The Algonkian rocks form a compressed syncline on the whole, with many minor foldings along axes both parallel to the main axis and at right angles with it. The whole series pitch downward to the west, so that as one goes in this direction later and later strata are encountered. The basal formation is the Mesnard quartzite, marking the advance of the sea from the eastward. It also appears to some extent around the northern and southern sides on the east. It is succeeded by the Kona dolomite, the Wewe slate, the Ajibik quartzite; the Siamo slate and the Negaunee formation of sideritic cherts, ferruginous slates, ferruginous cherts, jaspilite and iron ores. The last named is the stratum of the greatest economic interest, as it contains the chief deposits of ores. The derivation of the latter from the cherty carbonates in troughs of some impervious rock, by the replacement of the chert, is well established and is a further application of views already presented for the simpler Penokee-Gogebic district. A stratigraphical break occurs between the Lower and Upper Marquette series.

In Chapter VI., Professor Van Hise treats of the Upper Marquette series. The Upper Marquette begins with the Ishpeming formation, which is subdivided into the Goodrich quartzite and the Bijiki schists. Considerable ore bodies are in the base of the Goodrich quartzite, produced by the erosion of those in the Negaunee formation below, but they are treated under the Negaunee formation, as they are closely associated with it. Above the Ishpeming lies the Michigamme of slates and graywackes, mica-schists and mica-gneisses. Next follows the Clarksburg of effusive basic lavas

and fragmental volcanics, with occasional sediments interbedded. The Clarksburg formation is described by Dr. Bayley, who also, in Chapter V., discusses the various intrusive rocks that preceded the Clarksburg and those that follow it. In Chapter VI., H. L. Smyth describes in detail the interesting trough that runs off from the main Marquette syncline to the Republic mine. While the general relations are much like the large area, there are present of the Lower Marquette series only the Ajibik quartzite and the Negaunee iron-bearing formations, and of the Upper Marquette only the Goodrich quartzite and the Michigamme mica-schist. Minor peculiarities in local geology are also met. In Chapter VII., C. R. Van Hise gives a broad, general, structural discussion of the whole area. The monograph is illustrated by many plates and figures. The former include beautiful, colored reproductions of the rocks of the Negaunee formation that are associated with the iron-ores. An atlas of maps also accompanies the letterpress. Besides a general map there are thirty-five sheets of quarter townships, four inches to the mile.

The entire work is a monument to its authors and of incomparable interest alike to students of metamorphism, of economic geology and of structural geology. The mining operators of the region should find it a suggestive guide in new developments and exploratory work. The book is written in a clear and pleasing style which deserves commendation no less than does the scientific matter. J. F. KEMP.

The Phase Rule. By WILDER D. BANCROFT. Ithaca, N. Y., The Journal of Physical Chemistry. Large 8vo. Pp. viii+255. Paper. With numerous diagrams. Price, $3.00.

This interesting volume presents the subject of qualitative equilibrium of heterogeneous substances, on the basis of Gibbs' 'phase rule' and Le Chatelier's theorem. Mathematical theory, electro-chemistry and quantitative equilibrium are not discussed, but diverse phenomena in great variety, including the temperature, pressure and concentration of components are coördinated as examples of a few general principles. The general scope of the work can best be illustrated by a few subjects, selected from the many experimental data brought under review.

Water in an open vessel is not usually in a state of equilibrium, since evaporation takes place at the surface, and the liquid gradually diminishes in quantity. When the vapor is confined, in a limited space, its mass increases at any given temperature, until it exerts a certain definite pressure upon the surface of the water, and equilibrium results. With any change of temperature, some new pressure will be found before equilibrium is established; and if rectangular coördinates are used to represent the varying temperatures and pressures, some curved line will contain all the points which express conditions of equilibrium. Here is a system consisting of a single component in two phases, and the conditions of equilibrium are expressed graphically by a line. A definite change of either temperature or pressure or the density of water or vapor requires some definite change in another condition also. In this sense the conditions of equilibrium have but one degree of freedom, and the system is *monovariant*. Now, let the water be cooled until it begins to freeze. This implies a fixed temperature (0° C.) and a fixed vapor pressure of about 4.6 millimeters of mercury. If the system includes all three phases it is said to be *nonvariant*, and the conditions are represented by a single point in the diagram. At lower temperature the liquid will all freeze; at higher temperature the ice will melt. With increased pressure at zero all the vapor will be condensed; with diminished pressure all the liquid will gradually vaporize; in either case the system is reduced to two phases. A second curve of pressure can be drawn for ice in contact with vapor, and a third for ice in contact with liquid water, either system of two phases being *monovariant*.

When a salt, as potassium chloride, is added to the system in excess, there are two components, with the possibility of four phases; with the further addition of potassium nitrate, there are three components and may be five phases. In each case, if all components are present in the solid state, together with the saturated solution of all and the superincumbent vapor, the conditions of temperature, pressure and

concentration are all fixed; a change in any one of these conditions results in the elimination of one phase; or, if both temperature and pressure are made to change arbitrarily, equilibrium cannot be restored without the loss of two phases from the system. When two kinds of change may thus be made at pleasure, the system is said to be *divariant* and to have two degrees of freedom. It is here assumed that any disturbing effects due to gravity, electricity, capillarity or the distortion of solid masses are avoided, pressure and temperature being uniform throughout the system. The absolute and relative masses of the several phases have no effect upon equilibrium, except as some phase disappears entirely. The number of independent variables (including temperature and pressure) is two more than the number of components; and Gibbs' phase rule asserts that in the equilibrium of heterogeneous substances the number of degrees of freedom is equal to two more than the number of components, diminished by the number of phases. Thus, a non-saturated solution of a salt, in contact with vapor, may be altered at pleasure in regard to the concentration of the salt and either the temperature or the pressure; with two components in two phases, two arbitrary changes are subject to the will of the operator.

Le Chatelier's theorem asserts that "any change in the factors of equilibrium from outside is followed by a reverse change within the system." Thus, if a small amount of salt be added to the non-saturated solution, without change of temperature, this increase of concentration is offset in part by condensation of vapor and the pressure is therefore diminished. The system tends to return to its former condition of equilibrium by elimination of the disturbing element. Thus the sense of change resulting from the disturbance from conditions of equilibrium can be predicted, but the amount or rate of change involves quantitative relations which lie beyond the scope of the volume under review.

Experimental data are discussed, as indicated above, with regard to systems of one, two, three and four components. The relations of temperature, pressure and concentration are represented graphically. Much ingenuity has been shown in devising triangular diagrams to represent the relative masses of three substances by coördinates on a single plane. Melting and boiling points, critical temperature, allotropy, cryohydrates, solubility of anhydrous and hydrated salts, double salts, efflorescence, dissociation, supersaturation, volatile solutes, partially miscible liquids, eutectic mixtures and temperatures, fractional distillation, solid solutions, occlusion, alloys and fractional crystallization are among the subjects discussed, with numerous concrete examples.

The author's distinction between solvent and solute, or between solubility curve and fusion curve (as on pp. 36, 45, 95, etc.), does not find general acceptance. An attempt to determine the 'hypothetical line' of demarkation (page 158) may help to decide the point at issue.

While physical chemistry is rapidly gaining importance, many are deterred by the mathematical difficulties. To such, this work will give a welcome clew to the import of differential equations. Students of physical chemistry will here find a considerable field brought under review and duly systematized. Numerous indications are given of the present limitations of science and the open fields for profitable investigation.

ROBT. B. WARDER.

The Principles of Mathematical Chemistry; The Energetics of Chemical Phenomena. By DR. GEORG HELM. Authorized Translation by J. LIVINGSTONE R. MORGAN, PH. D. New York John Wiley & Sons; London, Chapman & Hall, Limited. 1897. 12mo. Pp. viii+228. Price, $1.50.

The original German edition has been recognized for three years or more as a work of value, and this translation will doubtless find a welcome. The principles of thermodynamics (including the conservation of energy) are asumed as the basis for the discussion. The intensity and quantity factors are distinguished in the various forms of energy, and the principle of constant or increasing entropy is applied to various reversible and non-reversible changes. Equations for chemical intensity are applied to electrolysis, simple chemical reactions, chemical equilibrium, freezing and boiling

points, vapor pressures, osmotic pressure, diffusion, speed of chemical reaction and to the phase rule.

ROBT. B. WARDER.

Observation on the Coloration of Insects. By BRUNNER VON WATTENWYL. Translated by EDWARD J. BLES, B.Sc., King's College, Cambridge. Leipsic, Engelmann. Fol. Pp. viii + 16. 9 plates.

In 1873, and again ten years later, Brunner published essays on 'hypertely,' or extravagance in nature, which are practically the foundation of the present work, in which an attempt is made to classify the fundamental phenomena of coloration in insects. These are treated of under the headings of uniform coloration, stripes and spots, the line of orientation ('indicating the position assumed by the insect in receiving its coloration'), strokes and dots, eyespots, spirals, splash marks, cloudings, stencil patterns, erosion, changes in pattern, enlargement or diminution of spots and bands, discoloration, diminution of patterns, changes due to adaptation, staining of contiguous parts, fading in covered parts, coloring in relation to position, and finally, as the summation of the whole, the arbitrariness of coloration. One quotation from the section on stencil patterns may be given as a good sample of his illustrations:

"In *Pseudocreobotra ocellata* Serv. one sees on the transparent, somewhat yellowish ground of the fore wings, firstly, a green patch, laid on as with a stencil. Then, in the middle of the green portion, opaque, citron yellow is laid on in the form of a spiral. The spiral is bordered with a heavy black line and in the center of the spiral there is a round spot of the same color.

"The black line obviously is meant to serve as a setting of the yellow spiral, yet careful examination reveals that the black marking is bodily shifted slightly inwards towards the insertion of the wing. For on this side, between the yellow spiral and the black line, a narrow strip of the green ground shows, while on the outer side the black border plainly encroaches upon the yellow ring. The shifting of the black marking is still more plainly shown by the small central spot not lying where it obviously should lie, but likewise shifted inwards.

"We have, consequently, three colors stencilled on the glassy wings: first green, then lemon yellow, and to complete the picture, a black body color; the latter is somewhat misfitted, as it may also be at times in our colored prints.

"I wish to lay stress on the agreement in this arrangement amongst all the many specimens which have passed through my hands. The idea can, therefore, not be entertained that the negligence described is a mere chance occurrence in one individual. The species was ornamented *once for all*, and just as it emerged from this operation, so has it been transmitted by inheritance."

He further mentions, in his final division, the case of an Acridian of the genus *Mastax*, in which a yellow stripe on the sides of the body includes the lower third of the facetted eyes, "and, as the stripe is formed by a body pigment, there is no doubt that the power of vision is destroyed in the part affected."

The author concludes that "the careless splashings, the defective stencil patterns or the impairment of vision by a band laid over the eyes and many other facts met with in the study of coloration cannot be brought into relation with any purposeful tendency. If one, therefore, calls modification through natural selection, Darwinism, a new name [Brunnerism?] must be introduced for the undoubtedly demonstrable occurrence of phenomena in the whole living world which have no relation to their owners or are occasionally harmful to them and hence are certainly not the result of selection."

Brunner combats the possibility of any gradual assumption of the more striking features, including the phenomena of mimicry, and, therefore, contends that they cannot be the result of natural selection; but he formulates no new law or process by which they can be presumed to have come into being, and so is forced to conclude that in the coloration of insects "we meet with an *arbitrariness* striving to produce attributes without regard for their possessors, and, therefore, obviously to be looked

upon as the emanation of a Will existing above the universe." This can hardly be looked upon as a compliment to the Deity.

The work is published in two editions (German and English), and is accompanied by nine exquisite plates, with 144 colored figures.

It is not a little curious that throughout the work the English translator uniformly uses 'colour' and 'coloured,' but 'coloration.' Is this to meet Americans half-way?

SOCIETIES AND ACADEMIES.

MEETING OF THE OHIO STATE ACADEMY OF SCIENCE.

THE seventh annual meeting of the Ohio State Academy of Science was held at the Ohio State University, Columbus, Ohio, on December 28 and 29, 1897, Dr. W. A. Kellerman, of Columbus, presiding. The meeting was well attended and much interest was manifested. The Society now numbers about two hundred, twenty names being presented for membership at this meeting.

The first paper, by R. J. Webb, was on 'The Fertilization of the Closed Gentian.'

Dr. D. S. Kellicott reported on Additions to the Odonato of Ohio. The list of dragon-flies for the State now numbers ninety-seven.

E. W. Vickers gave three short papers on 'The Pileated Woodpecker in Mahoning County,' 'Pickering's Hylodes in Ohio' and 'The Least Weasel in Ohio.'

Edo Claassen reported briefly on the following subjects: 'Occurrence of the Long-leaved Willow,' 'Abnormalities in Plants,' 'List of Liverworts of Cuyahoga and other Counties of Northern Ohio,' 'List of Plants New to the Flora of Ohio' and 'Erratic Boulders in the Valley of Rocky River.'

Dr. W. A. Kellerman gave the President's address on the subject: 'Does Modern Science furnish an Adequate Philosophy of Human Life?' and besides reported on the 'Distribution of the Green Ash in Ohio,' '*Ustilago reiliana*, Spermatophyta rare or new to the Ohio Flora' and 'Revision of the Catalogue of Ohio Plants.'

Professor F. M. Webster spoke on Some additions to the known insect fauna of Ohio.

R. C. Osburn and E. B. Williamson gave a description of a new species of fish, *Etheostama sciotense Osburn* and *Williamson*, a full description of which will appear in the Proceedings of the Society. They also gave a list of 69 species of fish for Franklin county, Ohio, and a list of the Crayfish of Ohio.

J. H. Shaffner read papers on 'Atavism in *Citrullus vulgaris*,' 'Notes on the Salt Marsh Plants of Northern Kansas' and 'Observations on the nutation of *Helianthus annuus*.'

Other papers were:

Notes on the Pleistocene geology in the vicinity of Devil's Lake, Wis., and dynamical modifications of quartzite: J. A. BOWNOCKER.

Science for the first year of the high school course, and Additions to the list of Ohio Fungi: F. L. STEVENS.

Science in the country school: E. E. MASTERMAN.

Cell-division in the Pine: E. L. FULLMER.

Embryology of a dicotyl: MISS L. C. RIDDLE.

Dissection of a double Trillium: MRS. W. A. KELLERMAN.

Additions to the list of plants of Ohio; Reversion of leaves to laments in tick-trefoil, and Evidence as to the origin of the islands of Lake Erie: E. L. MOSELEY.

The junction of the blue and yellow clays in the drift of northern Ohio, and recent beaches at Sandusky Bay and Sodus Bay: A. A. WRIGHT.

A list of the butterflies of Ohio (ninety-seven in number): J. S. HINE.

The Jonathan Creek drainage basin: H. J. DAVIS.

The preglacial drainage of Knox county: W. G. TIGHT.

Preglacial drainage in the vicinity of Cincinnati; The Ohio River a result of glacial conditions, and No evidence of an ice dam at Cincinnati: GERARD FOWKE.

Some new points on fin attachment of Dinichthys and Cladodus: WM. CLARK.

Four critical points in the valley of the Cuyahoga River: E. W. CLAYPOLE.

The following officers were elected for the ensuing year:

President—W. G. Tight, Granville.

Vice-Presidents—Josua Lindahl, Cincinnati; J. H. Todd, Wooster.

Secretary—E. L. Moseley, Sandusky.

Treasurer—D. S. Kellicott, Columbus.

Executive Committee—Mary E. Hart, Oxford; E. W. Vickers, Ellsworth.

Member of Publication Committee—Dr. S. Belle Craver, Toledo.

RAYMOND OSBURN,
Press Reporter.

THE WISCONSIN ACADEMY OF SCIENCES, ARTS AND LETTERS.

THE Academy held its 28th annual meeting at Milwaukee, December 27th–29th. The following were the principal scientific papers presented:

Reports of officers and other general business, 9:00 to 9:30 o'clock.

Reading of papers, 9:30 o'clock.

'Report on the progress of the Geological and Natural History Survey of Wisconsin,' Professor C. Dwight Marsh, President of the Academy, and Professor E. A. Birge, Director of the Survey.

'The Fresh-water Sponges of St. Louis Bay,' Mr. N. A. Harvey.

'The Relation of Motives to Freedom,' Professor E. H. Merrell.

'The Duration of School Attendance in Chicago and Milwaukee,' Professor Daniel Fulcomer.

'On the Meaning and Function of Thought-connective,' Professor E. T. Owen.

'The Psychology of the Sense of Injury,' W. F. Becker, M.D.

'The Succession-period of Generations,' Professor Chas. H. Chandler.

'On the Relation of Joints to the Forces which produce them,' Professor C. R. Van Hise.

'The Origin of Conglomerates,' Professor G. L. Collie.

'Notes on the Itasca Basin,' Mr. F. E. Lurton.

'On a plan to gather Information Concerning Wisconsin Diamonds,' Professor Wm. H. Hobbs.

'Recent Investigations to Determine the Relation of Crystal Forms to Chemical Composition,' Professor Wm. H. Hobbs.

'Observations of Nature and People in Eastern Siberia,' Isidor Ladoff.

'Observations on the Nocturnal Flight of Migrating Birds,' Dr. O. G. Libby.

'Unsteady Motion in Capillary Tubes,' Mr. H. C. Wolff.

'Theoretical Investigation of Motion of Groundwaters,' Professor C. S. Slichter.

'Pressures within a Heterogeneous Spheroid,' Professor C. S. Slichter.

'Recent Developments in the Electro-magnetic Theory of Light,' J. E. Davies.

'The Action of Dilute Solutions of Electrolytes on the Sense of Taste,' Dr. Louis Kahlenberg.

'Several Nitrogen addition products of Caryophyllene,' Professor Edward Kremers.

'A New Model of the Lobule of the Lung,' Professor W. S. Miller.

'A Study of the Variation in the Bileducts of the Cat,' Professor W. S. Miller.

In regard to the State Survey, Professor Marsh referred to the fact that $5.000 had been appropriated by the Legislature for each of two years, which was sufficient to pay the actual expenses incurred, while Professor Birge gave his services as Director free. Mr. E. R. Buckley is preparing a report on building stone, and Mr. Samuel Weidman on the geology of the vicinity of Merrill. Seven bulletins will be published during the coming year by the Survey, but that rate of publication cannot be maintained on the present revenne, since the Commission is availing itself of a large amount of work already done by individuals.

Professor Van Hise spoke at some length, following Professor Slichter's second paper, which the latter had worked out in response to geological queries. Professor Van Hise gave it as his conviction that vulcanism and the increasing heterogeneity of the earth had been by far the greater causes of the folding of the strata, and that computations concerned with the secular cooling of the earth were of slight value from a geological point of view.

A. S. FLINT.
Secretary.

PHILOSOPHICAL SOCIETY OF WASHINGTON.

THE 477th meeting was held Saturday evening, January 8th.

Mr. J. E. Watkins presented a paper on 'The Transportation and Lifting of Heavy Bodies by the Ancient Engineers.' The purpose of the paper was to show how many of the structures regarded as remarkable by expert engineers of the present day, and which some archæologists declare must have required in their erection the use of immense machines, could have been constructed by primitive tools and simple methods.

By means of diagrams the speaker explained how inclined planes of earth, etc., could be used in placing in position stone blocks or slabs of enormous weight, levels and pry-bars being

employed in setting them up. He then demonstrated how easily, comparatively speaking, the Pyramids could have been constructed by these simple methods, and when completed the earth around them which had been used for the inclined planes filled into the pits from which it was taken, leaving the ground as level as before.

As an illustration the Pyramid of Gizeh was cited, some of the stones of which were transported a distance of five hundred miles. In this case the highest embankment necessary when the workmen reached the top course, assuming that a 20% grade was adopted, would have been 750 yards long, containing, as it did, some seven and a half million cubic yards, provided the sides of the embankment would stand at an angle of 30°, which is not at all improbable. A force of ten thousand men could have built such an embankment in a single twelvemonth, a very small part of the total labor which it is stated called for the services of one hundred thousand men for twenty years.

In the solution of the problem of putting in place huge monoliths it was suggested that the modern engineer could well consider the utilization of inclined planes before adopting a more complex method.

The second paper was by Dr. T. J. J. See, of the Lowell Observatory, on 'Recent Discoveries of Double Stars in the Southern Hemisphere.' He recalled the climatic studies which led Mr. Lowell to locate the Observatory at Flagstaff, Arizona, and stated that what is needed now is not better telescopes, but better atmosphere. Since August, 1, 1896, he has been engaged on an extensive campaign for the discovery and measurement of double stars. Some 100,000 stars between —15° and —45° of declination had been examined and about 1,000 systems measured. He announced that he had forwarded to the *Astronomical Journal* a catalogue of 500 new double stars, many of which are of the highest interest.

The third paper was by Mr. C. D. Walcott, on the United States Forestry Reserve, which will be published in full in the *Popular Science Monthly*.

E. D. PRESTON,
Secretary.

GEOLOGICAL SOCIETY OF WASHINGTON.

AT the meeting of the Geological Society, of Washington, held on January 12, 1898, Mr. C. Whitman Cross, of the United States Geological Survey, read a paper on 'The Geological *vs.* the Petrographical Classification of Rocks.' This paper was an argument in favor of distinguishing between the systematic classification of rocks as concrete objects, in accordance with which they are described and named, *i. e.*, the petrographical classification, and the geological classifications necessary from several points of view. Many of the latter arrangements, such as that expressing genetic relationships of igneous rocks, are based on theory or hypothesis and produce instability if introduced into the systematic classification. It was urged that neither geological occurrence nor genetic relations should be used in sub-classification of igneous rocks. This paper will soon be published in full in the *Journal of Geology*, Chicago.

Arthur C. Spencer read a paper on 'The Upper Cretaceous Section in Southwestern Colorado.' For the purposes of geological mapping in southern Colorado it has been found necessary to subdivide the Upper Cretaceous section in a manner differing from that of common usage in the Rocky Mountain area. The Dakota occurs with its usual characters. Above it comes a series of shales, known to embrace the Benton, Niobrara and a part of the Pierre, which cannot be divided on lithologic grounds. The fossil-bearing layers are not persistent or numerous enough to serve as guides in areal mapping.

The upper part of the section has not received detailed examination. It consists of massive sandstones in which both the Fox Hills equivalent and that of the Laramie may prove to be present. This sandstone is overlain by the Animas beds, which are probably equivalent to the Denver beds of the Denver Basin.

W. F. MORSELL.
U. S. GEOLOGICAL SURVEY.

THE ACADEMY OF SCIENCE OF ST. LOUIS.

AT the meeting of the Academy of Science of St. Louis on the evening of January 3, 1898, nineteen persons present, the following officers for 1898 were installed: President, Edmund

A. Engler; Vice-Presidents, Robert Moore and D. S. H. Smith; Recording Secretary, William Trelease; Corresponding Secretary, Joseph Grindon; Treasurer, Enno Sander; Librarian, Gustav Hambach; Curators, Gustav Hambach, Julius Hurter; Directors, M. H. Post, Amand Ravold.

Dr. Amand Ravold spoke informally of formaldehyde gas as a disinfectant, and exhibited several forms of apparatus adapted to its use. It was stated that, although in confined spaces the gas has proved an effective disinfectant, which has the merit of not injuring the most delicate fabrics or polished metal surfaces, its germicide action in dwelling rooms has thus far proved less satisfactory than that of sulphur dioxide and chlorine, so far as it has been tested by the Health Department of the City of St. Louis; so that, as yet, the Health Department has not found it possible to employ it as a substitute for the older and in some respects more objectionable disinfectants.

Two persons were proposed for active membership in the Academy.

William Trelease.

SCIENTIFIC JOURNALS.

The American Geologist, January. Several important changes are to be adopted by this journal during the coming year. Professor N. H. Winchell is now the editor-in-chief, and there are eleven associate editors. A new department has been added, which is not covered by any other geological journal. This is a monthly authors' catalogue of American geological literature. Besides forming a part of the regular magazine, it is proposed to issue this catalogue on separate sheets for the benefit of librarians and investigators. The undertaking seems a very commendable one, and will form a valuable index. In the present number G. K. Gilbert gives a sketch of the life and works of the late Joseph F. James, with a portrait. N. H. Winchell elucidates the determination of the feldspars in a manner which will be found of much service to petrologists. The Pittsburg Coal Bed, one of the richest mineral deposits in the eastern United States, is described by I. C. White, in respect to its age, area and structure. The drilling for petroleum has shown that the coal area belonging to this bed is much smaller than has been estimated. The reviews of recent geological literature, personal and scientific news, and correspondence, are a feature of the magazine as heretofore.

American Chemical Journal, January. 'On Salts of Nitroparaffins and Acylated Derivatives of Hydroxylamine,' L. W. Jones. 'The Action of the Halogenes on the Aliphatic Amines and the Preparation of their Perhalides,' J. F. Norris: A comparison of the action of bromide and iodine and the formation of a number of perhalides containing one or more halides. 'On Acyl Imido Esters,' H. L. Wheeler, P. T. Walden and H. F. Metcalf. 'Notes on Double Salts of the Analides, with Cuprous Chloride and Cuprous Bromide,' W. J. Comstock.

J. Elliott Gilpin.

NEW BOOKS.

Lehrbuch der vergleichenden mikroskopischen Anatomie der Wirbeltiere. Albert Oppel. Jena, Gustav Fischer. 1897. 2d part. Pp. viii+682. M. 20.

Die Farnkräuter der Erde. H. Christ. Jena, Gustav Fischer. 1897. Pp. xii+388. M. 12.

L'électro Chimie. Ad. Minet. Paris, Gauthier Villars et Fils. 1897. Pp. 167. 2 fr. 50 c.

Transactions of the Congress of American Physicians and Surgeons, 4th Triennial Session. New Haven, Conn., Published by the Congress. Pp. liv+310.

Ethnological Studies Among the Northwest Central Greenland Aborigines. Walter E. Roth. Brisbane and London, Government Printer. 1897. Pp. xvi+199 and 23 plates.

Dissection of the Ophidian. David S. Kellicott. Columbus, O. 1898. Pp. 72.

The Psychology of Suggestion. Boris Sidis. With an introduction by William James. New York, D. Appleton & Co. 1898. Pp. x + 386. $1.75.

Evolutional Ethics and Animal Psychology. E. P. Evans. New York, D. Appleton & Co. 1898. Pp. 386. $1.75.